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IUCN Directory of South Asian Protected Areas

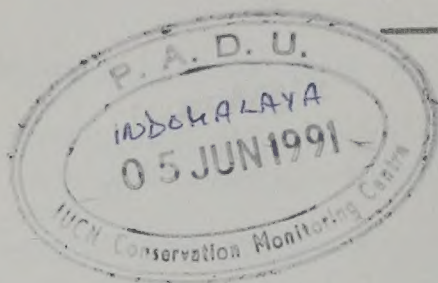
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IUCN Directory of South Asian Protected Areas

IUCN – THE WORLD CONSERVATION UNION

Founded in 1948, IUCN – the World Conservation Union – is a membership organisation comprising governments, non-governmental organisations (NGOs), research institutions, and conservation agencies in 120 countries. The Union's objective is to promote and encourage the protection and sustainable utilisation of living resources.

Several thousand scientists and experts from all continents form part of a network supporting the work of its six Commissions: threatened species, protected areas, ecology, sustainable development, environmental law and environmental education and training. Its thematic programmes include tropical forests, wetlands, marine ecosystems, plants, the Sahel, Antarctica, population and sustainable development, and women in conservation. These activities enable IUCN and its members to develop sound policies and programmes for the conservation of biological diversity and sustainable development of natural resources.

WCMC – THE WORLD CONSERVATION MONITORING CENTRE

The World Conservation Monitoring Centre (WCMC) is a joint venture between the three partners in the World Conservation Strategy, the World Conservation Union (IUCN), the World Wide Fund for Nature (WWF) and the United Nations Environment Programme (UNEP). Its mission is to support conservation and sustainable development by collecting and analysing global conservation data so that decisions affecting biological resources are based on the best available information.

WCMC has developed a global overview database of the world's biological diversity that includes threatened plant and animal species, habitats of conservation concern, critical sites, protected areas of the world, and the utilisation and trade in wildlife species and products. Drawing on this database, WCMC provides an information service to the conservation and development communities, governments and United Nations agencies, scientific institutions, the business and commercial sector, and the media. WCMC produces a wide variety of specialist outputs and reports based on analyses of its data.

IUCN Directory of South Asian Protected Areas

Compiled by

Michael J.B. Green

World Conservation Monitoring Centre

IUCN Commission on National Parks and Protected Areas

With financial support from

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FOREWORD

The Indomalayan Realm, corresponding approximately with tropical Asia, represents one of the biggest paradoxes in conservation. On the one hand, it extends over a number of densely settled nations, including three of the world's most highly populated (China, India and Indonesia), while, on the other, it supports perhaps the richest and most diverse biological communities on earth - moist tropical forests. The wealth of plant and animal species is due to many factors: great topographic diversity from sea level to the Himalayas, an enormously varied climate from the dry Thar desert to the world's wettest areas, and to plate tectonics which are responsible for the mosaic of shifting land masses and island archipelagos. The peripheral regions have gained much of their flora and fauna from the neighbouring cold Palaearctic, the hot, dry Afrotropics, and to a lesser extent from the Australian realm. But Indomalaya is the richest of these realms, at the heart of which lies its tropical forests - the "world's rain forests of grandest structure and of probably greatest richness in both animal and plant life" (T.C. Whitmore, *Tropical rain forests of the Far East*, 1975). The most diverse portion is Malesia, which is estimated to contain over 25,000 species of plants (about 10% of the world's total) and about 300 mammal species.

Protected areas are predominantly natural areas established and managed in perpetuity, through legal or customary regimes, primarily to conserve their natural resources. Despite the acute pressures of rapidly increasing human populations, more and more protected areas are still being declared in the Indomalayan Realm. Here, it is worth remembering that the concept of protecting natural areas in tropical Asia is very ancient and may have taken root in the Indian sub-continent, where the practice of affording special protection to patches of forest can be traced back several thousand years to hunter-gatherer societies. Many hundreds of 'sacred groves', so-called because they are dedicated to deities, still exist today.

Traditional conservation practices, of 'locking away' areas are becoming increasingly inappropriate, however, due to ever-mounting human pressures on natural resources. They are being superceded by more strategic approaches, enshrined in the *World Conservation Strategy* (1980) and based on managing natural areas to support sustainable development. The fundamental contribution of protected areas to sustainable development was reaffirmed by participants at the *3rd World Congress on National Parks* held in Bali, Indonesia (1982). In the Bali Action Plan, a target was set for 10% of each terrestrial ecosystem to be under some form of protection to stem the trend towards species depletion. This recommendation, considered to be realistic for many countries, has since been endorsed by UNEP and the Brundtland Commission.

The way in which protected areas networks have been rapidly developed in the Indomalayan Realm over the last few decades bears testimony to their importance being increasingly recognised by governments, aid agencies, non-governmental organisations and the public. In this directory for the South Asian region, the status of existing networks in Bangladesh, India, Pakistan and Sri Lanka is described as fully as the available information permits. In the case of India, protected areas are not individually described because the Ministry of Environment and

Forests is supporting the production of a series of state directories. These are being prepared by the Environmental Studies Division of the Indian Institute of Public Administration, and follow on from the *Directory of National Parks and Sanctuaries in India* produced in 1985.

The *IUCN Directory of South Asian Protected Areas* is the third in a series of regional directories prepared by the Protected Areas Data Unit, World Conservation Monitoring Centre, in collaboration with the IUCN Commission on National Parks and Protected Areas. It builds on the foundation provided by the *United Nations List of National Parks and Equivalent Reserves* (first published in 1961 and periodically updated since then) and the *World Directory of National Parks and Other Protected Areas* (1975, 1977), and a draft *Directory of Indomalayan Protected Areas* presented at the 25th Working Session of the IUCN Commission on National Parks and Protected Areas held in Corbett National Park, India in February 1985. Further directories covering other parts of the world are planned for publication in time for the *4th World Congress on National Parks and Protected Areas*, to be held in Venezuela in February 1992. The goal of the next Congress will be to further promote the effective management of the world's natural habitats. Basic information on protected areas, such as is provided in these directories, is a prerequisite for assessing the contribution of protected areas to the conservation of biological diversity and, ultimately, to sustaining human society.

Samar Singh

Vice-Chairman, Indomalayan Realm

IUCN Commission on National Parks and Protected Areas

INTRODUCTION

As recognised by participants at the *3rd World National Parks Congress*, the ready availability of comprehensive good-quality information on the world's protected areas is essential to a wide range of international organisations, governments, protected area managers, voluntary bodies and individuals. Such information is a prerequisite for assessing the coverage and status of protected areas from regional and global perspectives. Moreover, monitoring protected areas is vital to ensure that those areas allocated to conserve the world's natural resources meet the needs of society.

The World Conservation Monitoring Centre (WCMC) is gradually expanding its capabilities as an international centre for information on protected areas, which is managed by its Protected Areas Data Unit (PADU). As part of the WCMC core programme, PADU is gradually compiling a series of regional protected areas directories, with priority addressed to tropical countries where much of the world's biological diversity is to be found. Past work has been focussed on the Neotropics and Afrotropics, culminating in protected area directories published for each of these realms. Efforts have subsequently been concentrated on the Indomalayan Realm, beginning with the production of a draft *Directory of Indomalayan Protected Areas* circulated for review to participants at the *25th Working Session of the IUCN Commission on National Parks and Protected Areas* held in Corbett National Park, India in February 1985. Since then, the original material has been extensively revised and up-dated, with the incorporation of much additional material, commensurate with WCMC's developing capabilities.

The *Directory of South Asian Protected Areas* is the first in a series of volumes covering the Indomalayan Realm. It is due to be followed by a second volume for Mainland South-east Asia, already drafted and reviewed but awaiting funds for publication. It is anticipated that further volumes in this series will cover Malaysia, Indonesia and the Philippines, but these have yet to be drafted.

The present volume covers the protected areas systems of Bangladesh, India, Pakistan and Sri Lanka. Summary data are presented for all protected areas known to exist in these countries but only 100 properties are described in detail. This is largely a reflection of the availability of information, documentation on many of the less significant properties (often the smaller sites) being non-existent or not easily obtainable. That said, all 12 existing protected areas in Bangladesh and over half (36) of Sri Lanka's properties are described. Descriptive information for Pakistan is less comprehensive but the main protected areas are covered, with the exception of a few of the more recently notified national parks. No attempt has been made to compile descriptive information on Indian protected areas because such initiatives are already underway in-country. The Government of India has already supported the production of a *Directory of National Parks and Sanctuaries in India* (1985), and a series of state directories is now being prepared by the Environmental Studies Division, Indian Institute of Public Administration.

The way in which information on protected areas is managed at WCMC is described in the next chapter, and the structure and contents of the standard-format information sheets are outlined in the subsequent chapter. The directory is organised into chapters for each country. Each chapter comprises a description of the national protected areas system, accompanied by a summary list and map of protected areas, and is followed by descriptions of individual properties in alphabetical order. Geographical and taxonomic indexes enable the reader to refer quickly to individual properties and plant or animal species, respectively.

Acknowledgements

This directory has benefited from a tremendous amount of cooperation from within the South Asian region, highlighted in the case of the Sri Lankan authorities by the convening of a meeting specifically to review draft material. Many people have contributed to the preparation of the directory through reviewing or compiling material and providing new information. Their assistance is greatly appreciated. Those who spring to mind in the final hours of its preparation are listed below under respective country chapters. To others, whose contributions may have been overlooked inadvertently in the course of time, sincere apologies are due.

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A number of present and previous staff of PADU have been involved in the preparation of this directory. The first preliminary draft, presented at the *25th Working Session of the IUCN Commission on National Parks and Protected Areas*, Corbett National Park, India, 1985 was prepared by my predecessor Sally Ward. Other technical assistance has been provided by Harriet Gillett and James Paine, with secretarial support from Clare Billington and Alison Suter. Particular thanks are due to Jeremy Harrison, mentor and facilitator, and also Head of PADU. Others in WCMC who have contributed their expertise include Mike Adams, Steve Davis, Brian Groombridge, Tim Inskipp, Martin Jenkins, and Duncan Mackinder, and also Richard Grimmett and Tim Johnson from the International Council for Bird Preservation, and Derek Scott from the International Waterfowl and Wetlands Research Bureau. The support of our colleagues at IUCN headquarters is also acknowledged, notably Vitus Fernando, Jeffrey McNeely and

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Notwithstanding the significant contributions of those mentioned above, errors and omissions must remain the responsibility of the compiler. Corrections and additional material is always very welcome and can be sent to PADU at the address below.

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MANAGING INFORMATION ON PROTECTED AREAS AT WCMC

Institutional background

The IUCN Commission on National Parks and Protected Areas (CNPPA) has been actively involved in the collection and dissemination of information on protected areas ever since it was set up in 1960 to serve as the "leading international, scientific and technical body concerned with the selection, establishment and management of national parks and other protected areas". Over the years CNPPA's information management role increased to the extent that in 1981 it set up the Protected Areas Data Unit to undertake this service. Support for this initiative was forthcoming from the United Nations Environment Programme, as part of its Global Environmental Monitoring Programme. Originally part of the IUCN Conservation Monitoring Centre, PADU is now an integral part of the World Conservation Monitoring Centre, restructured in July 1988 as a joint venture between the three partners in the World Conservation Strategy, namely IUCN-The World Conservation Union, World Wide Fund for Nature (WWF) and the United Nations Environment Programme (UNEP).

Objectives

WCMC aims to provide accurate up-to-date information on protected area systems of the world for use by its partners (IUCN, WWF and UNEP) in the support and development of their programmes, other international bodies, governmental and non-governmental organisations, scientists and the general public. Such information covers the entire spectrum of protected areas, from national parks and sanctuaries established under protected areas legislation or customary regimes to forest reserves created under forestry legislation. It also includes privately-owned reserves in which nature is protected.

PADU has an integral relationship with CNPPA. In particular, PADU is responsible to CNPPA for producing the *United Nations List of National Parks and Protected Areas* (1982, 1985, 1990), which is periodically generated from its protected areas database currently totalling some 20,000 records. This database, together with supporting documentation, includes comprehensive information on natural sites designated under international conventions and programmes, namely the Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention), Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), and Unesco Man and Biosphere Programme. Thus, PADU cooperates closely with the Division of Ecological Sciences, Unesco, in maintaining information on Biosphere Reserves and World Heritage Sites accorded by the MAB Secretariat and World Heritage Committee, respectively. Likewise, it is responsible to the Ramsar Bureau for managing information on Ramsar Wetlands.

Information capture, management and compilation

Information is collected from official sources, viz. national agencies responsible for administering protected areas, and other sources through a global network of contacts ranging in profession from policy-makers and administrators to land managers and scientists. It is also obtained from published and unpublished literature. Regional CNPPA meetings and other relevant scientific and technical meetings provide valuable opportunities for making new contacts and collecting fresh information.

Information, ranging from books, reports, management plans, scientific papers, and maps, is stored as hard copy in manual files. Basic data on individual protected areas are extracted and, after verification, entered in a protected areas database. This computerised database can be used for generating lists of protected areas meeting pre-defined criteria, together with summary statistics, as well as performing more complex tasks. In addition, boundaries of protected areas are gradually being digitised, using a Geographic Information System, in order to be able to generate computerised mapped output. The raw information is also used for compiling information sheets on national protected areas systems (*protected areas systems information sheets*) and on individual protected areas (*protected areas information sheets*). These information sheets are compiled according to standard formats developed over the years by PADU in collaboration with CNPPA, details of which are given elsewhere in this directory.

Dissemination of information

Compiled information is periodically published in the form of regional or thematic directories, with sections on individual countries comprising a *protected areas system information sheet*, a *protected areas list* with accompanying *map*, and a series of *protected areas information sheets* covering at least the more important properties. Prior to releasing or publishing documents, draft material is circulated for review by relevant government agencies and experts to help ensure that compiled information is accurate and comprehensive. Regional and thematic directories published to date are as follows:

- IUCN Directory of Neotropical Protected Areas (1982)*
- IUCN Directory of Afrotropical Protected Areas (1987)*
- MAB Information System: Biosphere Reserves: Compilation 4 (1986)*
- Biosphere Reserves: Compilation 5 (1990)*
- Directory of Wetlands of International Importance (1987, 1990)*
- Protected Landscapes: Experience around the World (1987)*

Information is also made available to a wide range of users, including international organisations, governments, protected area managers, conservation organisations, commercial companies involved in natural resource exploitation, scientists, and the media and general public. It may be consulted by arrangement. Material may be prepared under contract: for example, PADU regularly provides UNEP with summary data on protected areas for its biennial *Environmental Data Report*. PADU is experimenting with providing outside users with direct access to its protected areas database. Trials have been ongoing with the US National Park Service since 1986 and it is hoped to be able to extend this service to other users in due course. PADU is also able to disseminate information through the *CNPPA Newsletter* and *Parks* magazine. In the case of the latter, PADU has recently assumed responsibility for compiling *Clipboard* in which world news on protected areas is featured.

INFORMATION SHEETS: GUIDELINES TO THEIR CONTENTS

Information Sheets on Protected Areas Systems

COUNTRY ¹

- Full name of country or political unit, as used by the United Nations (1982)

AREA

- Area of country or political unit according to the *Times Atlas of the World* (Seventh Edition, 1986), unless otherwise stated (with full reference). Terrestrial and marine components are distinguished, if appropriate.

POPULATION

- Population of country or political unit and its rate of natural increase according to the *Population Reference Bureau*, Washington DC, whose data are based on those of the United Nations Statistical Office. Year of census or estimate is indicated in parentheses. If another source has to be used, it is cited.

GNP

- Gross national product in US dollars, with year in parentheses, of country or political unit according to the *Population Reference Bureau*.

POLICY AND LEGISLATION

- Information on aspects of the constitution that are relevant to protected areas
- Details of national policies that relate to nature conservation, particularly with respect to the protection of ecosystems. Policies relating to environmental impact assessments and national/ regional conservation strategies are outlined.
- Brief historical account of national legislation and traditions that relate to the establishment of the protected areas system, with dates and numbers of acts, decrees and ordinances. Legislation covering forestry and other resource sectors is included, in so far as it provides for protected areas establishment. Procedures for the notification and declassification of protected areas are summarised.
- Outline of legal provisions for administering protected areas.

1 In the case of countries with federal systems of government, a single information sheet describes the protected areas system at both federal and state levels, except in the case of geographically disjunct regions .

- Legal definitions of national designations of protected areas, together with the names of the authorities legally responsible for their administration, are summarised. National designations are cited in the original language or transliterated, followed in brackets by the English translation as appropriate. Details of activities permitted or prohibited within each type of protected area and penalties for offences are outlined.
- Reviews of protected areas policy and legislation are noted with deficiencies in prevailing provisions highlighted.

INTERNATIONAL ACTIVITIES

- Participation in international conventions and programmes (World Heritage and Ramsar conventions, MAB Programme, UNEP Regional Seas Programme) and regional agreements (African, ASEAN, Berne, FAO Latin American/Caribbean Technical Cooperation Network, South Asian Cooperative Environmental Programme, South Pacific, Western Hemisphere) relevant to habitat protection is summarised, with details of dates of accession or ratification *etc.*
- Outline of any cooperative programmes or transfrontier cooperative agreements relevant to protected areas

ADMINISTRATION AND MANAGEMENT

- All authorities responsible for the administration and management of protected areas are described, including a brief history of their establishment, administrative organisation, staff structure, budget and any training programmes. Authorities responsible for different types of protected areas are clearly distinguished.
- Outline of the role of any advisory boards
- Cooperative agreements between management authorities and national or foreign universities and institutes, with details of any research underway or completed.
- Details of non-governmental organisations concerned with protected areas, including reference to any national directories of voluntary conservation bodies
- Effectiveness of protected areas management, noting levels of disturbance and threats to the national network. Attention is drawn to any sites registered as threatened under the World Heritage Convention, or by the IUCN Commission on National Parks and Protected Areas.

SYSTEMS REVIEWS

- Short account of physical features, biological resources, and land use patterns, including the extent and integrity of major ecosystems. (Appropriate sources of information include IUCN's *Plants in Danger*, protected areas systems reviews, and wetland and coral reef directories.)
- Brief historical account of nature conservation, so far as it relates to the establishment and expansion of the national protected areas network. Emphasis is given to any systems reviews or comprehensive surveys of biological resources, with details of major recommendations arising from such studies.
- Threats to the protected areas system beyond the control of the management agencies are outlined.

OTHER RELEVANT INFORMATION (optional)

- Tourism and other economic benefits of the protected areas system, if applicable
- Other items, as appropriate

ADDRESSES

- Names and addresses (with telephone, telex and FAX nos, and cable) of authorities responsible for administering protected areas, including the title of the post of the chief executive)
- Names and addresses (with telephone, telex and FAX nos, and cable) of non-governmental organisations, including the title of the post of the chief executive, actively involved in protected areas issues

REFERENCES

- Key references (including all cited works) to the protected areas system, in particular, and nature conservation, in general, are listed. Those not seen by the compiler are marked as 'unseen'.

DATE

- Date of last extensive 'review' and the most recent 'update'

DOCUMENT

- Reference number of the file in which the document is held on computer.

Information Sheets on Protected Areas ²

COUNTRY

- Short name of country or political unit, as used by the United Nations (1982)

NAME

- The name of the property or properties (including any collective name, if applicable), as designated in the original language or transliterated. Where appropriate, the English translation is given underneath. In the case of transliteration, standard systems are used.

IUCN MANAGEMENT CATEGORY

- The property is assigned to the most appropriate IUCN management category (see Annex 1) in collaboration with the IUCN Commission on National Parks and Protected Areas.

BIOGEOGRAPHICAL PROVINCE

- The biogeographical code, followed by the name of the province in brackets (after Udvardy, 1975)

2 *Sheets contain information on individual protected areas or clusters of such properties that form discrete conservation units. 'No information' is entered under any heading for which no data are available.*

GEOGRAPHICAL LOCATION

- The general location of the property within the country, including province and/or administrative district, proximity to major towns and/or topographical features, and means and ease of access. The location of different units is described, if applicable.
- The boundary of the property is briefly described, its relation to any significant political boundaries noted, and geographical coordinates are given.

DATE AND HISTORY OF ESTABLISHMENT

- The date of establishment, together with the act, decree or ordinance number of the original and subsequent legislative articles relating to its establishment. Proposed extensions or upgradings are detailed.
- A brief chronological history of previous designations, together with details of subsequent additions (including their sizes in hectares).
- If applicable, dates of inscription as World Heritage Site, Biosphere Reserve, Ramsar Wetland or other appropriate international and regional designations are given.

AREA

- The best estimate of total area in hectares (ha), together with sizes of individually gazetted units, if applicable. If this differs from the total area as notified, the discrepancy is indicated. The extent of terrestrial and marine components is specified, if appropriate.
- Contiguous or otherwise associated protected areas are noted and their sizes given in hectares (ha) in parentheses, including any lying across international borders.

LAND TENURE

- Land ownership (e.g. state, provincial, freehold, private, customary *etc.*), including sizes or proportions of respective areas if owned by several authorities

ALTITUDE

- Maximum and minimum altitude in metres (m)

PHYSICAL FEATURES

- General description of abiotic features, covering geology, topography, geomorphology, soils and hydrology

CLIMATE

- Seasons, annual precipitation, and maximum and minimum temperatures, with respect to altitude if appropriate. Other outstanding climatic features are noted.

VEGETATION

- Main vegetation types are briefly described, including their approximate coverage and state of preservation. Characteristic species are noted.
- Communities and species of particular interest, including endemic, globally threatened (see Annex 2), economically important and potentially economically important (e.g. crop relatives), and invasive or introduced species. Any nationally threatened species of direct relevance to management are also mentioned.
- References to vegetation descriptions and species inventories are included in the above.

NB Names of genera and families are based on Mabberley (1987).

FAUNA

- Mammal, bird, reptile, amphibian, fish and invertebrate faunas are described in relation to the different habitats, with emphasis on dominant, endemic, globally threatened (see Annex 2), economically important, and introduced or re-introduced species of particular interest. Where relevant, information is given on the use certain species make of habitats for breeding, stopover, migration, *etc.* Population sizes are given in the case of key species, with details of trends over specified periods of time.
- References to species inventories are included in the above.

NB Scientific nomenclature of species is based on Honacki *et al.* (1982) for mammals, Moroney *et al.* (1975) for birds, Frost (1985) for amphibians, Nelson (1984) for fishes and Parker (1982) for invertebrates. The preparation of a taxonomic reference for reptiles is being coordinated by The Association of Systematics Collections.

CULTURAL HERITAGE (if relevant)

- Archaeological features and cultural monuments
- Ethnic groups and their traditions
- Historical features

LOCAL HUMAN POPULATION (if relevant)

- Size of the human population resident, transhumant or nomadic within the property, together with details of the number and distribution of settlements
- Livelihoods of local populations are briefly described in relation to any zonation of the property, with details of land use (e.g. numbers of livestock and amount of land under permanent or shifting cultivation).
- Land use is described for the area surrounding the property, particularly as it impinges on the integrity of the property.

VISITORS AND VISITOR FACILITIES (if relevant)

- Annual number of visitors, together with proportions of nationals and foreigners for the latest year. Total revenue accruing from tourism is also indicated. Significant trends over specified periods of time are noted.
- Types of accommodation available on site (or nearby), with details of location and amount if it is particularly limited
- Availability and location of interpretation programmes, including visitor centres, educational facilities and museums
- Any other recreational facilities of particular interest

SCIENTIFIC RESEARCH AND FACILITIES

- A brief historical account of research undertaken, together with details of ongoing studies. Bibliographies, if compiled, are cited.
- Laboratories and other facilities, including accommodation, available to scientists

CONSERVATION VALUE

- Geological, scenic, biological, cultural and socio-economic values of the property, and justification for its conservation
- In the case of World Heritage sites, all natural and cultural criteria are outlined, based on the IUCN evaluation of the nomination submitted to the World Heritage Committee.

CONSERVATION MANAGEMENT

- A brief history of the conservation of the property, including any reasons for its original establishment where these differ from its present conservation value. Any legal provisions specific to the protection of the property are mentioned, together with details of activities (e.g. hunting, fishing, grazing) specifically permitted or prohibited.
- Administrative structure and management, including location of main facilities (e.g. headquarters)
- Management objectives, as drawn up in the management plan, and their degree of implementation. (The existence or absence of a management plan or 'statement of objectives' is noted and, if appropriate, the authority responsible for its implementation.)
- Major management activities (e.g. controlled burning, culling)
- Any system of zonation, including function and size of zones
- Significant training, interpretative and extension programmes
- Recommendations, particularly those made in the management plan, for future conservation and management of the property

MANAGEMENT CONSTRAINTS

- Past and current problems are briefly described, such as invasive species, poaching, fire, pollution, disease, agricultural encroachment, impact of tourism, relationship between management authorities and local people, lack of trained manpower or equipment, and proposed developments (e.g. roads, dams), with emphasis on the main types of threat and their extent. Threats from within and outside the property are distinguished.
- If a property is registered as threatened by the IUCN Commission on National Parks and Protected Areas or under any national or international convention (e.g. World Heritage), details are provided.

STAFF

- Numbers of staff allocated to each position and, if applicable, details of voluntary staff for the latest year, with trends if significant

BUDGET

- Annual budget for the latest year (in parentheses) in local currency, and in US dollars for ease of comparison. Capital (e.g. construction of facilities) and recurrent (e.g. salaries) costs are distinguished. Significant trends are noted.
- Financial support from outside sources

LOCAL ADDRESSES

- Names and addresses (with telephone, telex, FAX nos, and cable) of the local authorities responsible for the day-to-day administration and management of the property, including the title of the post of the chief executive (i.e. park warden or equivalent)
- Names and addresses (with telephone, telex, FAX nos. and cable) of any local non-governmental organisations directly involved in the protection and management of the property, including the title of the post of the chief executive

REFERENCES

- Key references, including management plans, reports, scientific monographs, bibliographies and handbooks, in addition to other scientific papers or popular articles and books specifically about the property. Particularly relevant references not available for consultation are also listed and cited as 'unseen'.

DATE

- Date of last extensive 'review' and the most recent 'update'

DOCUMENT

- Reference number of the file in which the document is held on computer.

REFERENCES

- Frost, D.R. Ed. (1985). *Amphibian species of the world: a taxonomic and geographical reference*. Allen Press and The Association of Systematics Collections, Lawrence, Kansas, USA. 735 pp.
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ANNEX 1

Categories and management objectives of protected areas

- I Scientific Reserve/Strict Nature Reserve:** to protect nature and maintain natural processes in an undisturbed state in order to have ecologically representative examples of the natural environment available for scientific study, environmental monitoring, education, and for the maintenance of genetic resources in a dynamic and evolutionary state.
- II National Park:** to protect natural and scenic areas of national or international significance for scientific, educational and recreational use.
- III Natural Monument/Natural Landmark:** to protect and preserve nationally significant natural features because of their special interest or unique characteristics.
- IV Managed Nature Reserve/Wildlife Sanctuary:** to assure the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment where these require specific human manipulation for their perpetuation.
- V Protected Landscape or Seascape:** to maintain nationally significant natural landscapes which are characteristic of the harmonious interaction of man and land while providing opportunities for public enjoyment through recreation and tourism within the normal life style and economic activity of these areas.
- VI Resource Reserve:** to protect the natural resources of the area for future use and prevent or contain development activities that could affect the resource pending the establishment of objectives which are based upon appropriate knowledge and planning.
- VII Natural Biotic Area/Anthropological Reserve:** to allow the way of life of societies living in harmony with the environment to continue undisturbed by modern technology.
- VIII Multiple-Use Management Area/Managed Resource Area:** to provide for the sustained production of water, timber, wildlife, pasture, and outdoor recreation, with the conservation of nature primarily oriented to the support of economic activities (although specific zones may also be designated within these areas to achieve specific conservation objectives).
- IX Biosphere Reserve:** to conserve for present and future use the diversity and integrity of representative biotic communities of plants and animals within natural ecosystems, and to safeguard the genetic diversity of species on which their continuing evolution depends.
- X World Heritage Site:** to protect the natural features for which the area is considered to be of World Heritage quality, and to provide information for world-wide public enlightenment.

Abridged from IUCN (1984)

ANNEX 2

IUCN Threatened species categories

Species identified as threatened by IUCN are assigned a category indicating the degree of threat. Definitions are as follows:

- (Ex) **Extinct:** species not definitely located in the wild during the past 50 years.
- (E) **Endangered:** taxa in danger of extinction and whose survival is unlikely if causal factors continue operating.
- (V) **Vulnerable:** taxa believed likely to move into the 'Endangered' category in the near future if causal factors continue operating.
- (R) **Rare:** taxa with small world populations that are not at present 'Endangered' or 'Vulnerable' but are at risk.
- (I) **Indeterminate:** taxa known to be 'Endangered', 'Vulnerable' or 'Rare' but where there is insufficient information to say which of these categories is appropriate.
- (K) **Insufficiently known:** taxa that are suspected, but not definitely known, to belong to any of the above categories because of lack of information.
- (T) **Threatened:** threatened is a general term to denote species which are 'Endangered', 'Vulnerable', 'Rare', 'Indeterminate' or 'Insufficiently known'. It is used to identify taxa comprised of several sub-taxa which have differing status categories.
- (C) **Commercially Threatened:** taxa not currently threatened with extinction but most or all of whose populations are threatened as a sustainable resource, or will become so unless their exploitation is regulated.

Abridged from IUCN (1988)

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BANGLADESH

Area 144,000 sq.km

Population 114,700,000 (1989) **Natural Increase** 2.8% per annum

GNP US\$ 160 per capita (1987)

Policy and Legislation Environmental policy in Bangladesh is based on the following three broad principles: precautionary, whereby harm to the environment is avoided; originator, whereby the costs of ameliorating damage to the environment are borne by those responsible; and cooperation, whereby relevant bodies are involved in planning for environmental protection (Rahman, 1983).

The need for an explicit national policy on environmental protection and management has been repeatedly highlighted (BARC, 1987), and is presently under consideration by the government. Objectives of such a policy will be as follows: to create, develop, maintain and improve conditions under which man and nature can thrive in productive and enjoyable harmony with each other; to fulfill the social, economic and other requirements of present and future generations; and to ensure the attainment of an environmental quality that is conducive to a life of dignity and well-being (Rahman, 1983).

Environmental impact assessment for anticipating adverse impacts has not yet been incorporated into the development planning process, nor is it a mandatory requirement of project-approving agencies. According to government policy, sanctioning agencies should ensure that project proposals contain adequate environmental safeguards but, in practice, this is not strictly followed (BARC, 1987).

Bangladesh has completed the first phase of a national conservation strategy aimed at integrating conservation goals with national development objectives and overcoming identified obstacles to sustainable development (BARC, 1987). Some twenty sectors in the current Third Five Year Plan are identified for critical analysis during a second phase, including the conservation of genetic resources, and wildlife management and protected areas. The Bangladesh Agricultural Research Council, Ministry of Agriculture is the lead agency for the implementation of Phase II which began in October 1989.

There is no national wildlife conservation policy. The Bangladesh Wildlife (Preservation) Order, 1973, promulgated under Presidential Order No. 23 on 27 March 1973 and subsequently enacted and amended in two phases as the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974, provides for the establishment of national parks, wildlife sanctuaries, game reserves and private game reserves. A national park is defined as a comparatively large area of outstanding natural beauty, in which the protection of wildlife is paramount and to which the public may be allowed access for recreational and educational purposes. A wildlife sanctuary

is an area closed to hunting and maintained as an undisturbed breeding ground, primarily for the protection of all natural resources, including vegetation, soil and water. A game reserve is an area in which the wildlife is protected but hunting is allowed on a permit basis. Under Article 23, cultivation, damage to vegetation, killing or capturing wild animals within a radius of 1.6km outside its boundary, and pollution of water is not allowed in either a national park or wildlife sanctuary. Entry or residence, introduction of exotic or domestic species of animals and lighting of fires is prohibited in wildlife sanctuaries, but not national parks. By contrast, firing of guns or other forms of disturbance to wild animals is prohibited in national parks, but not wildlife sanctuaries. No specific rules are detailed for game reserves. The Article makes provision, however, for the Government to relax any of these prohibitions for scientific, aesthetic or other exceptional reasons, and to alter the boundaries of protected areas. Under Article 24, provision is made for the establishment of private game reserves upon application by the landowner. The owner of a private game reserve may exercise all the powers of an officer provided under the Act. Proposals are being drawn up to strengthen the existing legislation, largely through raising fines and terms of imprisonment for offences.

Conservation, use and exploitation of marine resources are provided for under the Territorial Water and Maritime Zones Act, 1974. According to provisions in this Act, conservation zones may be established to protect marine resources from indiscriminate exploitation, depletion or destruction. At present, there is no legal provision for the management of coastal zones.

The Forest Act, 1927 enables the government to declare any forest or waste land to be reserved forest or protected forest. Activities are generally prohibited in reserved forests; certain activities, such as removal of forest produce, may be permitted under license in protected forests while others, such as quarrying of stone and clearing for cultivation, may be prohibited. The rights of government to any land constituted as reserved forest may be assigned to village communities, with conditions for their management prescribed by government. Such forests are called village forests. Under the Forest (Amendment) Ordinance, 1989, penalties for offences committed within reserved and protected forests have been increased from a maximum of six months imprisonment and a fine of Tk 500 to five years imprisonment and a Tk 5,000 (US\$ 1,700) fine. In accordance with the National Forest Policy, adopted in 1979, effective measures will be taken to conserve the natural environment and wildlife resources. The Policy does not, however, deal explicitly with the need to set aside special areas as protected forests, as distinct from productive forests, to preserve genetic diversity and maintain ecological processes within the context of sustainable development (BARC, 1987).

Other environmental legislation less specifically related to protected areas is reviewed elsewhere (DS/ST, 1980; Rahman, 1983).

International Activities Bangladesh is party to the Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) which it accepted on 3 August 1983. No natural sites have been inscribed to date. Bangladesh participates in the Unesco Man and Biosphere Programme. Apart from a couple of reserved forests proposed as candidate sites by the Bangladesh MAB National Committee in the late 1970s, there does not appear to have been any significant development in recent years. A proposal to become a party to the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) was submitted to the erstwhile Ministry of Agriculture and Forestry by the Forest Department and awaits approval. It is proposed to nominate the Sundarbans mangrove

forests as a wetland of international importance, in partial fulfilment of the requirements of the Convention (Rahman and Akonda, 1987).

Administration and Management Wildlife conservation, including the management of protected areas, is the responsibility of the Forest Directorate within the new Ministry of Environment and Forests formed in 1989. Previously, the Forest Directorate came under the Ministry of Agriculture and Forests while the former Department of Environmental Pollution Control, concerned largely with environmental pollution, was under the Ministry of Local Government and Rural development.

In 1976 a Wildlife Circle was established within what was then known as the Forest Department, with specific responsibility for wildlife matters under the charge of a Conservator of Forests responsible directly to the Chief Conservator of Forests. A \$13.3 million scheme, entitled "Development of Wildlife Management and Game Reserves", was incorporated within the country's First Five Year Plan, but reduced to \$92,000 in the subsequent Two Year Approach Plan (Olivier, 1979). The Wildlife Circle was subsequently abolished in June 1983, allegedly in the interests of economy and following the recommendations of the Inam Commission. The post of Conservator of Forests (General Administration and Wildlife) remains but the incumbent has many other administrative duties unrelated to wildlife. Following its general down-grading within the Forest Department, wildlife conservation has become the theoretical responsibility of the various divisional forest officers (Blower, 1985; Husain, 1986). Separate staff are deployed for protection purposes in a number of national parks and wildlife sanctuaries (Sarker and Fazlul Huq, 1985).

The Bangladesh Wildlife (Preservation)(Amendment) Act, 1974 also provides for the establishment of a Wildlife Advisory Board, which was set up in 1976 under the chairmanship of the Minister of Agriculture. The Board is supposed to approve important wildlife management decisions and directives (Olivier, 1979). Although it still exists, it does not appear to be a dynamic force (Blower, 1985; BARC, 1987).

In view of the low priority accorded to protected areas, a Task Force was formed by the Ministry of Agriculture in 1985 to identify institutional and other measures needed to improve current provisions for wildlife conservation. Recommendations of the Task Force, submitted to the government in July 1986, await approval by the competent authority. They include a plan to immediately revive the erstwhile Wildlife Circle, review Phase II of the Wildlife Development Project and secure protection of 5% of the total land area of the country for conservation purposes (Rahman and Akonda, 1987).

The principal non-governmental conservation organisations within the country are the Society for Conservation of Nature and Environment (SCONE), which is mainly concerned with environmental pollution, and the Wildlife Society of Bangladesh. Pothikrit, based in Chunar, and Polli Unnayan Sangstha (POUSH), founded in 1984, are both involved in promoting the adoption of sound management practices in and around protected areas. Their efforts are presently focussed on Chunar Wildlife Sanctuary and Teknaf Game Reserve.

Given that wildlife resources are vested largely in reserved forests, their conservation has in the past been diametrically opposed to forest management practices. Few, if any, protected areas are effectively managed and protected. Lack of personnel trained in wildlife conservation is a further handicap (Olivier, 1979; Gittins and Akonda, 1982; Khan, 1985). The very low priority

apparently now accorded to wildlife conservation is reflected in the recent abolition of the Wildlife Circle, the reassignment of staff to normal duties, the lack of any separate financial provision within the Forest Directorate's budget and the now moribund Wildlife Advisory Board (Blower, 1985).

Systems Reviews Some 80% of Bangladesh is lowland, comprising an alluvial plain cut by the three great river systems (Ganges-Padma, Brahmaputra-Jamuna and Meghna) that flow into the Bay of Bengal. Typically, at least one-half of the land is inundated annually, with one-tenth subject to severe flooding. The entire flood plain was well-vegetated, but much of the forest has been replaced by cultivations and plantations in recent decades due to mounting pressure from human populations. Here, the only extensive tract of forest remaining is the Sundarbans. Hills are confined chiefly to the east and south-east, notably the Chittagong Hills where forest cover is among the most extensive in the country.

According to the 1987 Statistical Yearbook of Bangladesh, forests cover 2.1 million hectares or 14.7% of total land area but this represents neither the area under forest nor that under the control of the Forest Department (Rashid, 1989). In 1980, Gittins and Akonda (1982) estimated remaining natural forest to be 4,782 sq.km (3.3%) and scrub forest 9,260ha (6.5%). Actual forest cover is presently estimated to be 1 million hectares or 6.9% of total land area, a reduction of more than 50% over the past 20 years (WRI/CIDE, 1990).

The major forest types are mangrove, moist deciduous or sal *Shorea robusta*, restricted to the Madhupur Tract and northern frontier with Meghalaya, and evergreen forests found in the eastern districts of Sylhet, Chittagong and Chittagong Hill Tracts. A small amount of freshwater swamp occupies the basins of the north-east region.

Wetlands, variously estimated as covering between seven and eight million hectares or nearly 50% of total land area, support a variety of wildlife, as well as being of enormous economic importance (Scott, 1989).

The only known coral reef is around Jinjiradwip (St Martin's Island) in the Bay of Bengal. It is reputed to be a submerged reef but little is known about it (UNEP/IUCN, 1988).

Conservation efforts began in 1966, prior to independence, when the Government of Pakistan invited the World Wildlife Fund to assess its wildlife resources and recommend measures to arrest their depletion. Two expeditions were mounted (Mountfort and Poore, 1967, 1968) and the severity of the situation confirmed, whereupon the Government was urged to appoint its own Wildlife Enquiry Committee. The committee was established in 1968 and by 1970 had drafted a report. That part relating to East Pakistan was published as a separate report (Government of East Pakistan, 1971). Considerable progress was made with the establishment of several protected areas (Mountfort, 1969), research undertaken on the Sundarbans tiger population of East Pakistan (Hendrichs, 1975), and technical input from UNDP/FAO (Grimwood, 1969). Then, in 1971, came the War of Liberation which inevitably disrupted subsequent progress. In spite of political instability, however, the Bangladesh Wildlife (Preservation) Order was promulgated in 1973 and an ambitious programme of wildlife management developed, followed by the formation of a Wildlife Circle in 1976 and further technical assistance from UNDP/FAO (Olivier, 1979). Economic constraints, however, have subsequently been responsible for the loss of much of this initiative (Blower, 1985).

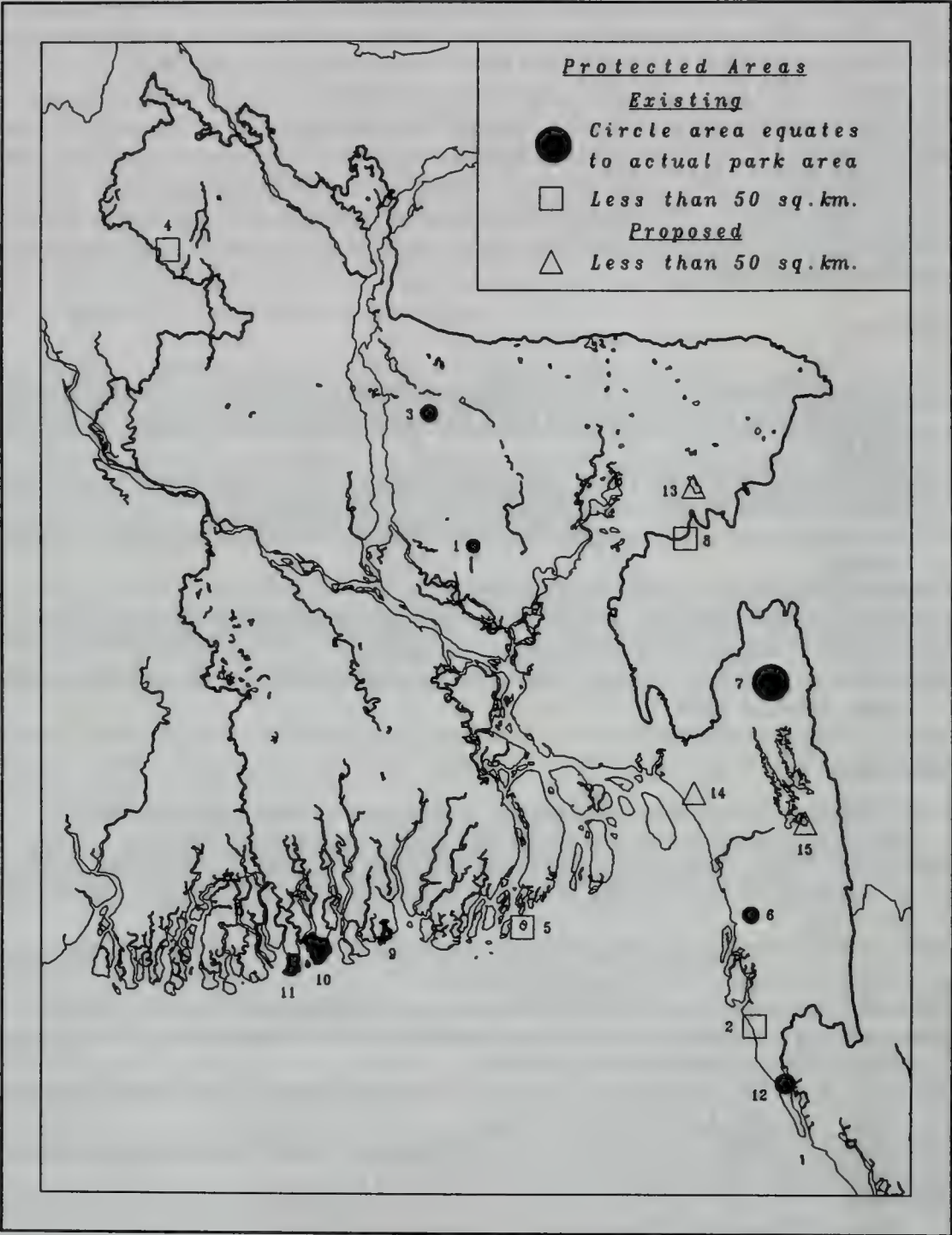
The existing system of protected areas has recently been reviewed (Green, 1989). It is not comprehensive, having been established with little regard to ecological and other criteria, and falls well below the target of 5% recommended by the erstwhile Ministry of Agriculture Task Force. Some effort has been made to include representative samples of the major habitats but, for example, marine and freshwater areas have been largely neglected (Olivier, 1979; Gittins and Akonda, 1982; Khan, 1985; Rahman and Akonda, 1987). Priorities to develop the present network of protected areas are identified in the IUCN systems review of the Indomalayan Realm (MacKinnon and MacKinnon, 1986) and further recommendations are made in the Corbett Action Plan (IUCN, 1985), many of which are based on earlier recommendations by Olivier (1979). More recently, wetlands of conservation value have been identified (Scott, 1989). Of outstanding importance is the need to prepare a plan for the development of the country's protected areas network.

Addresses

- Conservator of Forests (General Administration and Wildlife), Office of the Chief Conservator of Forests, Bana Bhawan, Gulshan Road, Monakhali, DHAKA 12 (Cable FORESTS; Tel. 603537)
- Chief Conservator of Forests, Forest Directorate, Ministry of Environment and Forests, Bana Bhawan, Gulshan Road, Monakhali, DHAKA 12 (Cable FORESTS)
- Polli Unnayan Sangstha, 43 New Eskaton Road, DHAKA (Tlx 642639 OCNBJ; Tel. 402801, 406628)
- Pothikrit, CHUNATI VILLAGE, Chittagong District
- Secretary General, The Society for Conservation of Nature and Environment, 146 Shanti Nagar, DACCA 17 (Cable ENVIRON DHAKA; Tel. 409119)
- General Secretary, Wildlife Society of Bangladesh, c/o Department of Zoology, University of Dhaka, DHAKA 1000

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Protected areas of Bangladesh
Numbers correspond to those in the summary.

Summary of Protected Areas of Bangladesh

<i>National designation</i> Name of area and map reference ¹	IUCN Management category	Area (ha)	Year notified
<i>National Parks</i>			
1 Bhawal*	V	5,022	1982
2 Himchari*	Unassigned	1,729	1980
3 Madhupur*	V	8,436	1982
4 Ramsagar*	Unassigned	52	1974
Subtotal (% total land area)		15,239	(0.1%)
<i>Wildlife Sanctuaries</i>			
5 Char Kukri-Mukri*	IV	40	1981
6 Chunati*	IV	7,764	1986
7 Pablakhali*	IV	42,087	1983
8 Rema-Kalenga*	IV	1,095	1981
9 Sundarbans East*	IV	5,439	1977
10 Sundarbans South*	IV	17,878	1977
11 Sundarbans West*	IV	9,069	1977
Subtotal (% total land area)		83,369	(0.6%)
<i>Game Reserves</i>			
12 Teknaf*	VIII	11,615	1983
Subtotal (% total land area)		11,615	(0.1%)
<i>Proposed</i>			
13 Hail Haor Wildlife Sanctuary*	Proposed	1,427	
14 Hazarikhil Wildlife Sanctuary*	Proposed	2,903	
15 Rampahar-Sitapahar Wildlife Sanctuary*	Proposed	3,026	
TOTALS			
Existing areas (% total land area)		110,226	(0.8%)
Proposed areas (% total land area)		7,356	(0.1%)

¹Locations of protected areas are shown in the accompanying map.

* Site is described in this directory.

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Date July 1984, updated August 1990

BHAWAL NATIONAL PARK

IUCN Management Category V (Protected Landscape)

Biogeographical Province 4.03.01 (Bengalian Rainforest)

Geographical Location Lies in Dhaka Forest Division, about 40km north of the capital city of Dhaka, from where it is easily accessible throughout the year by road. 24°01'N, 90°20'E

Date and History of Establishment Established and maintained as a national park since 1974 but not officially declared as such until 1982, under the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974.

Area 5,022ha

Land Tenure State

Altitude Up to 4.5m

Physical Features The topography is characterised by low hills which rise 3.0-4.5m above the surrounding paddy fields. These hills or ridges, locally known as 'chalias', are intersected by numerous depressions or 'baidis'. The soil is yellow-red, comprising sandy clay mixed with magniferous iron ores.

Climate Conditions are moderate, the coldest and hottest months being January (down to 10°C) and April (up to 37°C), respectively. The cold season lasts from November to January. Mean annual rainfall is 2500mm, most of which falls in the monsoon between June and September.

Vegetation Most of the original sal *Shorea robusta* forest has been destroyed. It has been protected from further destruction and now, due to extensive regeneration, coppiced and seedling sal covers 90% of the area (Womersley, 1979; Sarker and Fazlul Huq, 1985).

Fauna Mammal diversity is low. Species include fox *Vulpes bengalensis*, jackal *Canis aureus*, small Indian civet *Viverricula indica*, wild boar *Sus scrofa* and black-naped hare *Lepus nigricollis*. The avifauna is similar to that found in Madhupur National Park (Sarker and Fazlul Huq, 1985).

Cultural Heritage No information

Local Human Population Some 2,000 people reside and cultivate land in the national park.

Visitors and Visitor Facilities Public usage is intense, with 25,000 visitors recorded at weekends (Womersley, 1979). Accommodation includes four rest houses and two cottages. Recreational and educational facilities include some 25km of trails, an artificial lake, two ponds and two observation towers.

Scientific Research and Facilities A wildlife survey was carried out by the Forest Directorate in 1981 (Sarker and Fazlul Huq, 1985).

Conservation Value Bhawal is not an important wildlife conservation area but, being close to a large urban centre, it is valued for recreational purposes (Olivier, 1979).

Conservation Management Recreational and educational facilities were improved and developed under the management of the Forest Department, but plans were subsequently discontinued. Forestry operations are limited to re-forestation of damaged areas (Olivier, 1979; Womersley, 1979; Sarker and Fazlul Huq, 1985).

Management Constraints The original forest vegetation has been removed and wildlife severely depleted.

Staff No information

Budget No information

Local Addresses No information

References

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Date May 1987, updated August 1990

CHAR KUKRI-MUKRI WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.03.01 (Bengalian Rainforest)

Geographical Location Lies on Char Kukri-Mukri Island, in southern Charfession Upazilla, Bola District, some 130km from Barisal Town in the Gangetic Delta of southern Bangladesh. 21°55'N, 90°38'E

Date and History of Establishment Declared a wildlife sanctuary in 1981 under the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974. Also referred to as Charfession Wildlife Sanctuary.

Area 40ha

Land Tenure State

Altitude No information

Physical Features Char Kukri-Mukri, lying in the outer Gangetic Delta, is a small low-lying island (2,500ha) with extensive mudflats. At high tide much of it is under water, apart from agricultural land. The sanctuary is dissected by small khals or creeks (Sarker and Fazlul Huq, 1985; Scott, 1989).

Climate Rainfall is heavy and humidity high due to the influence of the Bay of Bengal. Mean annual rainfall is likely to be in the region of 2790mm, with 80% falling in the monsoon from June to September, as recorded on the Sundarbans coast (Seidensticker and Hai, 1983).

Vegetation Comprises mangrove forest. Patches of hogla *Typha elephantina* and horgoja *Acanthus illicifolius* occur in places; keora *Sonneretia apetala* is widespread; and khalisha *Aegiceras maius* is also present. A thick growth of the small spiny 'tamfulkanta' tree covers much of the sanctuary (Sarker and Fazlul Huq, 1985).

Fauna Common mammals include fishing cat *Felis viverrina* and Oriental small-clawed otter *Aonyx cinerea*. More than eight species of heron breed in the sanctuary. Other waterfowl include egrets, bitterns and grey pelican *Pelecanus philippensis*. All three monitor species known for Bangladesh are reported from this sanctuary, *Varanus salvator*, *V. bengalensis* and *V. flavescens* (Sarker and Fazlul Huq, 1983). Further details of the waterfowl are given by Scott (1989).

Cultural Heritage No information

Local Human Population The sanctuary is not inhabited but the south-west of the island is settled and plantations cover 1,500ha. Much of the surrounding land has been cultivated (Sarker and Fazlul Huq, 1985; Scott, 1989).

Visitors and Visitor Facilities No information

Scientific Research and Facilities Some preliminary floral and faunal surveys have been undertaken (Scott, 1989).

Conservation Value Char Kukri-Mukri is an important wetland site (Scott, 1989).

Conservation Management The best area of mangrove forest in the island is included within the wildlife sanctuary. No forestry activities are carried out in the mangroves apart for the purpose of conserving wildlife populations (Scott, 1989).

Management Constraints No information

Staff No information

Budget No information

Local Addresses No information

References

- Sarker, N.M. and Fazlul Huq, A.K.M. (1985).** Country report on national parks, wildlife sanctuaries and game reserves of Bangladesh. Prepared for the 25th Working Session of IUCN's Commission on National Parks and Protected Areas. Corbett National Park, India. 4-8 February 1985. 5 pp.
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Date May 1987, updated August 1990

CHUNATI WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.04.01 (Burman Rainforest)

Geographical Location Lies about 70km south of Chittagong Port, Chittagong and Cox's Bazaar districts. The eastern boundary is formed by the Chittagong-

Cox's Bazaar Highway. 22°08'-22°53'N, 91°58'-92°05'E

Date and History of Establishment Formerly part of the reserved forests of Chittagong Forest Division, the area was designated a wildlife sanctuary on 8 March 1986 (Notification No. XII/For-I/84/174).

Area 7,763.97ha

Land Tenure State

Altitude Up to 90m

Physical Features The sanctuary is bisected along its north-south axis by a range of hills, some 60-90m high. Spurs projecting from this range are separated by deep ravines. The area is drained by four major streams.

Climate No information

Vegetation The area used to support subtropical semi-evergreen forest, dominated by garjan *Dipterocarpus* spp. Associates were ratkan *Lophopetalum* spp., jam *Syziium* spp., uriam *Mangifera* spp., chapalish *Artocarpus* spp., simul *Salmalva* spp., korai *Albizia* spp. and toon *Cedrela* spp. Bamboos and grasses were profuse. Much of the original vegetation has been heavily disturbed through commercial exploitation, illegal felling and encroachment (Jalil, n.d.).

Fauna Wildlife populations are depleted due to heavy disturbance to the habitat. Some 26 species of mammals are reportedly present, including rhesus macaque *Macaca mulatta*, common langur *Presbytis entellus*, Hoolock gibbon *Hylobates hoolock* (V), dhole *Cuon alpinus* (V), fox *Vulpes bengalensis*, leopard *Panthera pardus* (T), tiger *P. tigris* (E), Indian elephant *Elephas maximus* (E), Indian muntjac *Muntiacus muntjak* and sambar *Cervus unicolor* (Ahmed, n.d.). A resident herd of 15 to 30 elephant is present, as well as a dozen of the nationally rare serow *Capricornis sumatraensis*. Tiger *Panthera tigris* (E), last recorded in 1983, may also be present (IUCN, 1990).

Some 40 species of birds have been recorded, including a variety of birds of prey, pheasants and fish-eating species (Ahmed, n.d.).

Cultural Heritage ‘Chuna’ means chosen and, according to legend, Chunati was chosen by members of Shah Shuja’s caravan who remained in the area while the Prince continued his journey to Arakan to flee from his brother, Aurangzeb. The history of the region has since been recorded in Persian by scholars from the region (Rahman, 1989).

Local Human Population Surrounding areas are settled. About 500 households distributed among 10-12 villages depend on the sanctuary’s wood resources as a source of income (IUCN, 1990).

Visitors and Visitor Facilities No information

Scientific Research and Facilities A preliminary inventory of the mammals and birds has been compiled (Ahmed, n.d.).

Conservation Value Chunati lies at the northern edge of one of the most dense tropical rain forests in Bangladesh. It supports a rich flora and fauna and its diminishing resources are vital for the poor and landless (Rahman, 1989; IUCN, 1990).

Conservation Management A citizens committee, known as Pothikrit, was responsible for persuading the government to declare the area a wildlife sanctuary. Since then, Pothikrit has been raising the level of awareness among the poor and landless farmers about the need to conserve forest resources. For example, poor people dependent on the sanctuary’s wood resources have been engaged in forestry activities in peripheral areas to plant and raise trees. In time, this may ease pressure on the sanctuary and adjacent forests (Anon., 1990; IUCN, 1990).

Chunati has not been subject to any management regime since its inception. Plans have been drawn up, however, to restore the sanctuary to its original condition but await sanctioning. Priorities include the provision of adequate staffing and quarters, development of pastures and waterholes for wildlife, and construction of visitor facilities (Jalil, n.d.).

Management Constraints Encroachment has been a persistent problem in and around the sanctuary. The forest has been cleared for cultivation by wealthy land-owners. Timber and firewood resources have been legally and illegally extracted for many years, this being the major cause of depletion and loss of wildlife habitat. Timber traders represent a strong vested-interest group and are located near the sanctuary. Impoverished fuelwood gatherers have also traditionally depended on the resources of the sanctuary, as it represents their major source of income, particularly outside the agricultural season. In addition, wildlife is under constant threat from

chronic hunting and poaching. The Forest Department has so far proved to be ineffective in arresting deforestation and the decline of wildlife within the sanctuary and, at present, there is no management plan. Unless new management measures are implemented soon, it is anticipated that the sanctuary will be destroyed within 15 years. These constraints are addressed in a project proposed by IUCN (1990) to assess the forest resources in Chunati and the dependence of the local people on them, and to prepare a management plan.

Staff Presently staffed by one honorary wildlife warden but one assistant conservator of forests, one forest ranger, one forester, forest guards and honorary wildlife wardens are proposed (Jalil, n.d.).

Budget No information

Local Addresses Divisional Forest Officer, Chittagong Forest Division

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Date July 1989, updated August 1990

HAIL HAOR WILDLIFE SANCTUARY

IUCN Management Category Proposed

Biogeographical Province 4.09.04 (Burma Monsoon Forest)

Geographical Location Hail Haor, a wetland, lies 3km north-west of Srimangal and 14km south-west of Moulavi Bazar in Moulavi Bazar District, Sylhet. 24°18'-24°26'N, 91°38'-91°45'E

Date and History of Establishment No existing conservation status

Area An area of 1,427ha is proposed for designation as a wildlife sanctuary. The area of the wetland varies from a minimum of 3,643ha in the dry season to a maximum of 8,906ha in the rainy season.

Land Tenure State

Altitude c. 5m

Physical Features Comprises a large shallow lake in a saucer-shaped depression, bounded in the south, east and west by low hills and in the north by the plains of the Manu and Kushiara rivers. The haor is almost encircled by a chain of tea estates and natural forest blocks. Gopla River flows through the wetland in a north-south direction. The lake floods during the rainy season to a maximum depth of 3m, and almost dries up during the dry season. Land exposed as the water level recedes is converted to rice paddies. Much of the lake's surface is overgrown with lotus and water hyacinth.

Climate Conditions are subtropical monsoonal, with a mean annual rainfall of approximately 4000mm. Temperatures at Srimangal normally vary between a maximum of 32.8°C and a minimum of 9.0°C.

Vegetation The aquatic vegetation includes *Typha elephantina*, *Trapa bispinosa*, *Nelumbo nucifera*, *Hygrophiza aristata*, *Eichhornia crassipes* and species of *Utricularia*, *Ceratophyllum*, *Vallisneria*, *Hydrilla*, *Najas*, *Potamogeton*, *Nymphoides*, *Pistia*, *Lemna* and *Azolla*. Plant communities in adjacent areas include *Bambusa* spp., *Musa* spp., *Mangifera indica*, *Erythrina* spp. and *Crataeva nurvula*.

Fauna In the 1960s, it was estimated that some 100,000 lesser whistling duck *Dendrocygna javanica*, 1,000 fulvous whistling duck *D. bicolor* and 40,000-50,000 migratory ducks frequented the lake in early winter. In recent years, however, the number of Anatidae visiting the lake has decreased dramatically, although there may still be 10,000-15,000 ducks present in late November and even larger numbers in late February and March. Lesser whistling duck and cotton pygmy goose *Nettapus coromandelianus* are common residents, breeding at small lakes and ponds throughout the region and congregating in large numbers at Hail Haor during the cold season. Fulvous whistling duck is a cold season visitor, usually arriving in January and sometimes in very large numbers. Much the commonest migrant ducks are garganey *Anas querquedula*, northern pintail *A. acuta*, and northern shoveler *A. clypeata*, although common teal *A. crecca* and pochard *Aythya nyroca* sometimes occur in large numbers. Gadwall *Anas strepera*, spotbill duck *A. poecilorhyncha* and tufted duck *Aythya fuligula* are regular visitors in small numbers. Bar-headed goose *Anser indicus* was formerly a regular winter visitor to the area, but now occurs only as an occasional passage migrant in flocks of up to 40 birds. Greylag goose *Anser anser*, ruddy shelduck *Tadorna ferruginea*, comb duck *Sarkidiornis melanotos*, teal *Anas falcata*, mallard *A. platyrhynchos*, red-crested pochard *Netta rufina*, common pochard *Aythya ferina* and Baer's pochard *A. baeri* have been recorded as rare visitors. Hail Haor is also important for many other species of waterfowl such as little grebe *Tachybaptus ruficollis*, little cormorant *Phalacrocorax niger*, Indian pond heron *Ardeola grayii*, cattle egret *Bubulcus ibis*, little egret *Egretta garzetta*, intermediate egret *E. intermedia*, great egret *E. alba*, water cock *Gallicrex cinerea*, moorhen *Gallinula chloropus*, purple swamphen *Porphyrio porphyrio*, common coot *Fulica atra*, pheasant-tailed jacana *Hydrophasianus chirurgus*, bronze-winged jacana *Metopidius indicus*, painted snipe *Rostratula benghalensis*, red-wattled lapwing *Vanellus indicus*, a wide variety of migratory shorebirds, and whiskered tern *Chlidonias hybrida*. Open-bill stork *Anastomus oscitans* is a regular visitor, and the rare Goliath heron *Ardea goliath* and Blyth's kingfisher *Alcedo hercules* have been recorded. Birds of prey include osprey *Pandion haliaetus*, Eurasian marsh harrier *Circus aeruginosus* and pied harrier *C. melanoleucos*.

Other wildlife known to occur in the area includes a variety of snakes, monitor lizards, freshwater turtles, tortoises and frogs. Fishes include *Catla catla*, *Labeo rohita*, *L. calbasu*, *L. gonius*, *Cirrhina mrigala*, *Barbus* spp., *Wallago attu*, *Mystus tengra*, *M. aor*, *Oampok pabda*, *Gadusia*

chapra, *Clupea* spp., *Notopterus notopterus*, *Clarius batrachus*, *Heteropnuestes fossilis*, *Channa* spp., *Anabas testudineus* and *Colisa fasciata*. Freshwater shrimps of the genus *Macrobrachium* are common.

Cultural Heritage No information

Local Human Population Fishing is the principal activity, but this is declining due to large portions of the lake basin being leased to local people for cultivation. During the dry season, aquatic vegetation is collected for the preparation of compost. There is also a considerable amount of legal and illegal hunting at the lake. Surrounding areas are under cultivation, mainly for rice.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Some research has been carried out on the waterfowl populations, notably a study by the Forest Department in 1980 and a survey by scientists from the Bangladesh Zoological Society in 1985. Mashu Kabir made regular observations of the Anatidae between 1973 and 1987. Botanical studies have also been carried out.

Conservation Value Hail Haor is one of the most important wetlands in the Sylhet Basin for both resident and migratory waterfowl. The lake is particularly important as a refuge in periods of drought, when many other wetlands in the area dry out completely.

Conservation Management The Forest Department has established a centre for the protection of waterfowl from illegal hunting and trapping.

Management Constraints The level of the wetland is rising as a result of increased siltation caused by soil erosion in the water catchment area, and large areas of the lake basin are being converted to agricultural land. There is considerable disturbance to waterfowl populations from hunting, fishing and agricultural activities throughout the year. Very heavy hunting pressure on both resident and migratory species of waterfowl reportedly occurred in the winter of 1984/85.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date March 1989, updated August 1990

HAZARIKHIL WILDLIFE SANCTUARY

IUCN Management Category Proposed

Biogeographical Province 4.04.01 (Burman Rainforest)

Geographical Location Lies in the Ramgarh-Sitakunda forests, 45km north of Chittagong Port in south-east Bangladesh. 91°40'E, 22°40'N

Date and History of Establishment Proposed as a wildlife sanctuary in 1967. Maintained since the mid-1970s by the Forest Directorate.

Area 2,903ha. According to a report by the Divisional Forest Officer, the proposed area is 2,033ha (Olivier, 1979).

Land Tenure State

Altitude Mean altitude is 350m.

Physical Features The terrain is irregular, comprising ridges from which numerous spurs protrude in various directions. Soils vary from clay to clay-loam on level ground, and from sandy loam to coarse sand on the hills. The sandy soil is often impregnated with iron.

Climate Conditions are moist tropical. Mean annual rainfall is 3000mm, falling mainly between June and September (Sarker and Fazlul Huq, 1985).

Vegetation Comprises evergreen and semi-evergreen forests. Predominant tree species are *Dipterocarpus* spp., *Artocarpus chaplasha*, *Tetrameles nudiflora*, *Cedrela toona*, *Mesua ferrea*, *Eugenia* spp., *Ficus* spp. and *Albizia procera*. The undergrowth is dominated by bamboos and *Eupatorium odoratum* (Sarker and Fazlul Huq, 1985).

Fauna Mammals known to be present include rhesus macaque *Macaca mulatta*, capped langur *Presbytis pileata*, dhole *Cuon alpinus* (V), sloth bear *Melursus ursinus* (I), wild boar *Sus scrofa* and Indian muntjac *Muntiacus muntjak* (Sarker and Fazlul Huq, 1985). Hoolock gibbon *Hylobates hoolock* (V), leopard *Panthera pardus* (T), and Phayre's leaf monkey *Presbytis phayrei* may also be present (Olivier, 1979), as may sambar *Cervus unicolor* (S.M. Saheed, pers. comm., 1989). Indian python *Python molurus* (V) is reported to be present but low in number (Sarker and Fazlul Huq, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities Limited census of the wildlife has been undertaken (Olivier, 1979).

Conservation Value The area is reportedly rich in wildlife (Olivier, 1979).

Conservation Management Though not yet notified a wildlife sanctuary, forestry operations have been suspended (Sarker and Fazlul Huq, 1985) and some 12km of the boundary demarcated (Olivier, 1979).

Management Constraints No information

Staff Quarters for staff have been constructed (Olivier, 1979) but the present level of staffing is not known.

Budget No information

Local Addresses No information

References

Olivier, R.C.D. (1979). *Wildlife conservation and management in Bangladesh*. UNDP/FAO Project BGD/72/005. FAO, Forest Research Institute, Chittagong. 121 pp.

Sarker, N.M. and Fazlul Huq, A.K.M. (1985). Country report on national parks, wildlife sanctuaries and game reserves of Bangladesh. Prepared for the 25th Working Session of IUCN's Commission on National Parks and Protected Areas. Corbett National Park, India. 4-8 February 1985. 5 pp.

Date May 1987, updated August 1990

HIMCHARI NATIONAL PARK

IUCN Management Category Unassigned

Biogeographical Province 4.04.01 (Burman Rainforest)

Geographical Location Lies 1.5km to the south of Cox's Bazar township in the Chittagong Hill Tracts. Forms part of Cox's Bazaar Peninsular Reserved Forest. 21°22'N, 92°02'E

Date and History of Establishment Declared a national park in 1980 under the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974. Previously established as a reserved forest under the Forest Act, 1927 and subsequently declared a game reserve, with an area of 2,331ha.

Area 1,729ha

Land Tenure State

Altitude No information

Physical Features The terrain is irregular with steep-sided hills aligned in a north-to-south direction, and bounded on the west by the Bay of Bengal. Soils comprise clay loams and loams on hills, and sands along beaches.

Climate Conditions are moist, humid and maritime, with little temperature variation. Rainfall is high, falling mainly between May and October.

Vegetation Characteristically comprises tropical semi-evergreen forest, which is dense and multi-storeyed. Deciduous trees predominate in the upper canopy, common species including *Albizia procera*, *Artocarpus chaplasha*, *Salmaalina malabarica* and *Sterculia alata*. The sub-canopy is dominated by a great variety of evergreen species including *Quercus*, *Castanopsis*, *Eugenia*, *Lannea*, *Lagerstroemia* and *Amoora spp.* The undergrowth consists mainly of bamboo (Sarker and Fazlul Huq, 1985).

Fauna Mammals include gibbon *Hylobates hoolock* (V), capped langur *Presbytis pileatus*, rhesus macaque *Macaca mulatta*, leopard *Panthera pardus* (T), dhole *Cuon alpinus* (V), leopard cat *Felis bengalensis*, jungle cat *F. chaus*, fishing cat *F. viverrina*, sloth bear *Melursus ursinus* (I), elephant *Elephas maximus* (E), Indian muntjac *Muntiacus muntjak* and wild boar *Sus scrofa* (Sarker and Fazlul Huq, 1985). Hog-badger *Arctonyx collaris* and pangolin *Manis* sp. may also be present (S.M. Saheed, pers. comm., 1989). There are many species of birds. The reptile fauna is rich and includes Indian python *Python molurus* (V) (Sarker and Fazlul Huq, 1985).

Cultural Heritage No information

Local Human Population No information

Scientific Research and Facilities No information

Conservation Value Limited due to the poor quality of the habitat and its isolation (Olivier, 1979).

Conservation Management Blocks 34, 35 and 37 (totalling 2,331ha) were originally recommended as a 'Class A' national park (Government of East Pakistan, 1971). In the event, Blocks 35 and 37, which still contained commercially valuable forest, were rejected in favour of Blocks 30, 32 and 33, which consisted of poor-stature, partially-logged, semi-swamp forest whose further exploitation had been abandoned. Thus, not only does the area afford poor habitat for wildlife, but it is isolated from all other forests within the division (Oliver, 1979). A development scheme prepared for the park and to be executed by the Divisional Forest Officer has not yet been approved (Sarker and Fazlul Huq, 1985).

Management Constraints The park is encroached by hundreds of villagers entering daily to cut timber (Rashid, 1990).

Staff No information

Budget No information

Local Addresses Divisional Forest Officer, Cox's Bazaar Forest Division

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Date May 1987, updated August 1990

MADHUPUR NATIONAL PARK

IUCN Management Category V (Protected Landscape)

Biogeographical Province 4.03.01 (Bengalian Rainforest)

Geographical Location Situated in the Madhupur tract (Mymensingh Forest Division), some 160km north of the capital city of Dhaka and 32km south-west of Mymensingh Town. The park is bounded by the Mymensingh-Tangail road to the south-east, forest to the north-west and by agricultural land and settlements on other sides. It is easily accessible throughout the year and is bisected by an 8km-long semi-metalled road from Rasulphur to Dokhola. 24°45'N, 90°05'E

Date and History of Establishment First established as a national park in 1962 but not officially declared as such until 1982, under the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974. Received special protection as a vested forest in 1959 under the provisions of the East Pakistan Private Forest Ordinance, 1959.

Area 8,436ha

Land Tenure State

Altitude Rises up to 15m above sea level.

Physical Features The local topography is characterised by flat topped ridges, known locally as 'chalas', intersected by numerous depressions or 'baid's'. Two small rivers, Banar and Bangshi, flow through the eastern and western portions of the park, respectively. Soils are mostly pale brown to yellow-red (acidic) clay-loams to clays on 'chalas' and grey, silty clay-loams to clays in valleys.

Climate Conditions are moderate, with April the hottest month (maximum of 37°C) and January the coldest (minimum of 10°C). The cold season lasts from November to February. Mean annual rainfall is 2500mm, most of which falls between June and September.

Vegetation Some 40% of the forest cover comprises sal *Shorea robusta* in association with *Dillenia pentagyna*, *Lagerstroemia parviflora*, *Adina cardifolia*, *Miliusa velutina*, *Lannea grandis*, *Albizia* spp., *Bauhinia variegata*, *Spondias mangifera*, *Butea frondosa* and *Barringtonia acutangula*. Species commonly occurring in the undergrowth include *Eupatorium odoratum*, *Pennisetum setosum*, *Asparagus racemosus* and *Rauwolfia serpentina* (Sarker and Fazlul Huq, 1985). Some areas are planted with *Tectona grandis*, *Cassia siamea*, *Morus* spp., *Terminalia arjuna*, *Syzygium cumini* and *Lagerstroemia speciosa*. A total of 149 tree species has been recorded (Akonda *et al.*, 1989).

Fauna The area used to be rich in wildlife, but Indian rhinoceros *Rhinoceros unicornis* (E) disappeared in the last century and, more recently, tiger *Panthera tigris* (E), leopard *Panthera pardus* (T), elephant *Elephas maximus* (E), all species of deer native to Bangladesh, wild buffalo *Bubalus bubalis* (E), and peafowl *Pavo* sp. have become locally extirpated (Reza Khan, 1985). Characteristic mammal species still remaining include rhesus macaque *Macaca mulatta*, capped langur *Presbytis pileatus* (V) (formerly one of the densest populations surviving in Bangladesh), jackal *Canis aureus*, fox *Vulpes bengalensis*, small Indian civet *Viverricula indica*, wild boar *Sus scrofa*, Irrawaddy squirrel *Callosciurus pygerythrus*, porcupine *Hystrix indica* and black-naped hare *Lepus nigricollis* (Sarker and Fazlul Huq, 1985; Khan, 1985). The capped langur population is thought to have declined in recent years - 548 individuals were counted in 1986 (Akonda *et al.*, 1989). Species inventories of 21 mammals and 29 reptiles have been compiled by Akonda *et al.* (1989). Clouded leopard *Neofelis nebulosa* (V) and Indian python *Python molurus* (V) may also be present (S.M. Saheed, pers. comm., 1989).

Some 140 species of birds were recorded in 1974-1975 by Hossain and Hoque (cited in Akonda *et al.*, 1989), of which 116 are residents and 24 migrants. According to Khan (1985), about 200 species are present.

Cultural Heritage No information

Local Human Population Some 4,500 Garos (tribals) were allowed to settle inside the park (Mountfort and Poore, 1968) but about 850 families have been resettled (Womersely, 1979). In 1989 there were some 14,000 Garos within the park, *plus* additional numbers of Bengalis. Rice is grown in low-lying areas, and pineapples and cassava on higher ground for commercial consumption. The surrounding area is densely populated (Green, 1989).

Visitors and Visitor Facilities There are three rest houses and a youth hostel providing overnight accommodation. Seven picnic spots have been provided by the Forest Directorate. The zoo is in a poor state. Visitor use is high, with many bus loads of holiday makers appearing on public holidays (Olivier, 1979; Womersley, 1979; Green, 1989).

Scientific Research and Facilities A wildlife survey was carried out by the Forest Directorate in 1981 (Sarker and Fazlul Huq, 1985). The capped langur population has been censused at various times, latterly in 1986 (Akonda *et al.*, 1989), and a preliminary ecological study undertaken (Stanford, 1989).

Conservation Value Madhupur features and best remaining patch of sal forest in Bangladesh (Khan, 1985). It is also important for its capped langur population (Akonda *et al.*, 1989)

Conservation Management The forests of Madhupur were formerly rich in wildlife and were a favourite tiger-hunting area (Olivier, 1979). By 1967, however, the area had lost much of its value for wildlife, owing to considerable disturbance, but its potential for recreation and education was recognised (Mountfort and Poore, 1968). Subsequently, it was recommended that Madhupur be established as a 'Class B' national park to provide "recreational and educational interest for the youth and people of urban areas" (Government of East Pakistan, 1971). In 1974-75 a programme was initiated to preserve the wildlife and to provide recreational and educational facilities for the local people and other visitors. With the establishment of the national park, all flat areas suitable for growing paddy were excised and 850 families of Garos were resettled (Womersley, 1979).

Trees have been planted in disturbed areas and an artificial lake created for migratory waterfowl (Sarker and Fazlul Huq, 1985). Madhupur warrants conservation priority over other areas of sal forest. It needs to be enlarged and brought under an effective wildlife management regime (Khan, 1985).

Management Constraints Management has always been problematic due to the large number of Garos settled in the park. Only about 1,300ha is under effective management, the rest of the park is in the hands of the Garos. The situation may improve with the recent tightening of the forestry legislation, with much heavier penalties for illicit felling. Also, initiatives are underway to enable local people to benefit from the park's resources (Green, 1989).

Staff A total of 60 staff, including two range officers and one deputy ranger, administers the three ranges (Headquarters, Dokhola and Arankhola).

Budget Tk 12 lakh (US\$ 40,000) is budgeted for staffing the three ranges (1989).

Local Addresses Officer-in-Charge, Madhupur National Park Headquarters, P.O. Gobtali, District Mymensingh

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Date May 1987, updated August 1990

PABLAKHALI WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.09.04 (Burma Monsoon Forest)

Geographical Location Lies at the northern end of Kaptai Reservoir in the south-eastern part of Kassalong Reserve Forest in the Chittagong Hill Tracts, some 112km from Rangamati Town. The western boundary is formed by Kassalong River. 23°08'N, 92°16'E

Date and History of Establishment Declared a wildlife sanctuary in 1983 under the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974. First established as a game sanctuary in June 1962.

Area 42,087ha

Land Tenure State

Altitude Ranges from 100m to 300m.

Physical Features The topography comprises a complex of hills and valleys aligned north-south, with spurs branching from the ridges. The hills are rugged and steeply sloping to the north, and smaller with gentler slopes to the south. Some 3,885ha in Working Unit I have been under water since 1963, following the construction of a dam at Kaptai as part of the Karnafuli hydro-electric project (Olivier, 1979). Soils are typically clay or clay loams in the valleys, and pale brown to yellow-red (acidic) clay loams and loams in the hills with localised concretions of iron-manganese.

Climate Conditions are typically sub-tropical with a long dry season lasting from November to May. Mean annual rainfall is 2500mm. Mean temperature ranges from 23°C in December to 35°C in May. Humidity is high throughout the year.

Vegetation Three forest types can be distinguished. Tropical wet evergreen forest commonly occurs in valleys and on sheltered slopes with a plentiful water supply. The irregular canopy, characterised by emergent trees, is dense and rich in species. Typical trees include civit *Swintonia floribunda*, garjan *Dipterocarpus* spp., *Pterygota alata*, *Quercus* spp. and *Castanopsis* spp. Tropical semi-evergreen forest, the most extensive forest type in the sanctuary, includes

a significant proportion of deciduous canopy species. The predominant tree genera are *Dipterocarpus*, *Mangifera*, *Amoora*, *Cinnamomum*, *Syzygium*, *Tetrameles*, *Artocarpus*, *Salmalia* and *Albizia*. Tropical moist deciduous forest is confined to new alluvial areas near rivers and streams. The trees are scattered and interspersed with extensive patches of khagra and nal grassland and stands of wild banana. Characteristic tree genera include *Albizia*, *Salmalia*, *Terminalia* and *Ficus*. Bamboo grows beneath the canopy of all three forest types (Sarker and Fazlul Huq, 1985).

Fauna According to reports in old district gazetteers, Kassalong Valley used to be rich in wildlife, with tiger *Panthera tigris* (E), two species of rhinoceros *Rhinocerotidae* spp., gaur *Bos gaurus* (V) and banteng *B. javanicus* (V) present in the 19th and early 20th centuries. Tiger, gaur and banteng were last seen in the early 1970s (Khan, 1985), but tiger and also leopard *Panthera pardus* (T) are reported to still occur (Sarker and Fazlul Huq, 1985). Most important is the small population of Asian elephant *Elephas maximus* (E) that commonly uses the southern part of the sanctuary, probably because of the mosaic of habitats and permanent water supply (Olivier, 1979). Many other large mammals are present, including rhesus macaque *Macaca mulatta*, capped langur *Presbytis pileata*, Hoolock gibbon *Hylobates hoolock* (V), dhole *Cuon alpinus* (V), small cats, otters and wild boar *Sus scrofa* (Sarker and Fazlul Huq, 1985), and also Indian muntjac *Muntiacus muntjak* and sambar *Cervus unicolor* (Olivier, 1979). Hague (1989) lists 61 species of mammals recorded in the late 1970s.

Some 133 bird species have been recorded from the sanctuary (Husain, 1975). This total includes 25 species previously reported by Mountfort (1969). Following the formation of Kaptai Reservoir and with the continuing reduction of former wintering grounds in Sylhet and Mymensingh, the sanctuary supports increasing numbers of resident and migratory waterfowl (Olivier, 1979), notably little grebe *Tachybaptus ruficollis*, a variety of herons and egrets, common moorhen *Gallinula chloropus*, common coot *Fulica atra* and Asian openbill stork *Anastomus oscitans* (Scott, 1989). White-winged wood duck *Cairina scutulata* (V) used to be common but the population has declined in recent years, most probably due to systematic clear-felling of primary forest and its replacement with commercially viable timber species (Khan, 1986). Some five pairs were present up to 1979, but the status of the species has since become uncertain owing to political disturbances (Khan, 1985). Khan (1986) estimates there to be some 20 pairs within an area of 240 sq.km in and around the sanctuary.

Of the reptiles, Indian python *Python molurus* (V) is common (Sarker and Fazlul Huq, 1985).

Cultural Heritage No information

Local Human Population Part of the sanctuary has been allotted to settlers from the plains. Rebel tribal groups operate in the area (Khan, 1985).

Visitors and Visitor Facilities Access to the Chittagong Hill Tracts has been restricted since 1982 for security reasons. There are two rest houses.

Scientific Research and Facilities The elephant population was surveyed by the Forest Directorate in 1978 (Olivier, 1979; Sarker and Fazlul Huq, 1985). The status of white-winged wood duck was first investigated by Husain (1975, 1977) and subsequently by Khan (1986) between 1978 and 1981. Its population dynamics and breeding behaviour were examined by an university student in 1976-1977 (Sarker and Fazlul Huq, 1985).

Conservation Value Pablakhali contains some of the finest lowland forest remaining in Bangladesh and is also an important wetland site (Scott, 1989).

Conservation Management Under the working plan, due to expire in 1988/1989, the sanctuary is divided into two working units. Some 25,900ha are allotted to Working Unit I, in which wildlife is protected and forestry operations are prohibited. In the remaining area allotted to Working Unit II, it is intended that wildlife preservation proceed alongside normal forestry operations. Working Unit I comprises some 3,885ha of reservoir, 1,554ha of teak plantation and 20,461ha of natural forest. This is nowhere more than 5km wide and runs north-south along the eastern edge of Working Unit II; to the east is unclassed state forest, which has been heavily disturbed by local hill tribesmen. Conversion of Working Unit II to plantations has been proceeding steadily (Olivier, 1979).

Some 7,770ha (Compartments 23-30) within Working Unit I were proposed as an elephant sanctuary, but the area was considered far too small and devoid of much suitable habitat. This proposal is thought to have arisen as a result of the Technical Sub-Committee of the Wildlife Enquiry Committee having originally proposed Compartments 23-30 as Pablakhali Wildlife Sanctuary (Olivier, 1979).

Management prescriptions include strict protection of the wildlife and provision of artificial feeding sites, waterholes and salt-licks. It was planned to limit forestry operations to thinning of existing plantations and impose a three-year cycle for collection of bamboo (Olivier, 1979).

Management Constraints Few of the original management prescriptions have proved possible to implement. Rice was cultivated beside the reservoir, grass cut for fodder and thatching material, and cattle roamed freely inside the sanctuary. Most serious is the encroachment on the narrow strip of natural forest running north-south. In many places, this had either gone or been reduced to a few hundred metres in width, thereby isolating the smaller southern part of the sanctuary from the rest and threatening the free movement of elephants to and from preferred feeding areas (Olivier, 1979). In the mid-1980s the government began to lease out forest lands, both within the sanctuary and neighbouring areas, to plains-dwellers for settlement at the rate of 2.5ha per family, as a counter-measure to tribal insurgency. This policy is very detrimental to wildlife, and much encroachment has resulted. Locals hunted white-winged wood ducklings with dogs in 1981 and this practice may be continuing (Khan, 1986).

Staff No information

Budget No information

Local Addresses Divisional Forestry Officer, Chittagong Hill Tracts (North) Forest Division

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Date June 1987, updated March 1989

RAMPAHAR-SITAPAHAR WILDLIFE SANCTUARY

IUCN Management Category Proposed

Biogeographical Province 4.04.01 (Burman Rainforest)

Geographical Location Lies 48km north-east of Chittagong Port. Approximately 22°30'N, 92°20'E

Date and History of Establishment Presently classified as reserved forest, Rampahar-Sitapahar has not yet been designated a wildlife sanctuary under the Bangladesh Wildlife (Preservation)(Amendment) Act, 1974 but has been maintained as such by the Forest Department since 1973 (Sarker and Fazlul Huq, 1985).

Area 3,026ha

Land Tenure State

Altitude No information

Physical Features Comprises low, gently sloping hills which are steeper in Sitapahar block than Rampahar block. The Karnaphuli River flows through the area. Soils are clays or clayey loams in valley bottoms and mostly pale brown (acidic) clay loams and loams on hills (Sarker and Fazlul Huq, 1985).

Climate Conditions are typically sub-tropical with a long dry season from October to May. Mean temperatures vary from 24°C in December to 35°C in May. Mean annual rainfall is 2500mm.

Vegetation Comprises evergreen and semi-evergreen forests. Predominant tree species are *Dipterocarpus* spp., *Artocarpus chaplasha*, *Tetrameles nudiflora*, *Cedrela toona*, *Mesua ferrea*, *Eugenia* spp., *Ficus* spp. and *Albizia procera* (Sarker and Fazlul Huq, 1985).

Fauna Mammals include capped langur *Presbytis pileatus*, sloth bear *Melursus ursinus* (I), Indian muntjac *Muntiacus muntjak* and sambar *Cervus unicolor*. Reptiles include python *Python molurus* (V) (Sarker and Fazlul Huq, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities No information

Conservation Value No information

Conservation Management Maintained as virgin forest by the Forest Department.

Management Constraints No information

Staff No information

Budget No information

Local Addresses No information

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Date March 1989, updated August 1990

RAMSAGAR NATIONAL PARK

IUCN Management Category Unassigned

Biogeographical Province 4.03.01 (Bengalian Rainforest)

Geographical Location Lies in Dinajpur District, about 9km from Dinajpur Town, in the extreme north-west of Bangladesh. 25°40'N, 88°30'E

Date and History of Establishment First established in 1960 but not officially notified as a national park until 1974.

Area 52ha

Land Tenure State

Altitude No information

Physical Features Ramsagar is a lake surrounded by high embankments. The embankments are flat-topped ridges, which slope gently down to the lake, and cover 50% of the area. The soil is red-yellow clay (Sarker and Fazlul Huq, 1985).

Climate No information

Vegetation Forest is absent. The flora consists of ornamental and fruit trees (Sarker and Fazlul Huq, 1985).

Fauna The diversity of mammals, birds and reptiles is low; such species as are present occur widely throughout the country (Sarker and Fazlul Huq, 1985).

Cultural Heritage It is believed that the lake was excavated by King Ramnath, Maharaja of Dinajpur, before the Battle of Plassey.

Local Human Population No information

Visitors and Visitor Facilities There is one rest house, and five picnic sites have been constructed by the Forest Department.

Scientific Research and Facilities No information

Conservation Value Minimal

Conservation Management It was originally recommended that Ramsagar be developed as a 'Class B' national park for purposes of recreation and education (Government of East Pakistan, 1971). Subsequently, under a separate development plan, the site was proposed as a recreation centre (Olivier, 1979). Information concerning the present management is not available.

Management Constraints No information

Staff / Budget No information

Local Addresses No information

References

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Date May 1987, updated August 1990

REMA-KALENGA WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.09.04 (Burma Monsoon Forest)

Geographical Location Situated in the Tarap Hills of Sylhet District in eastern Bangladesh, adjacent to the international border with India. The sanctuary is difficult to reach, particularly in the monsoon season. 24°05'N, 91°37'E

Date and History of Establishment Declared a wildlife sanctuary in 1981 under the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974, having previously been part of Kalenga (Tarap Hill) Forest Reserve.

Area 1,095ha

Land Tenure State

Altitude No information

Physical Features The Tarap Hills are dissected by numerous valleys, separated by ridges rising some 50m above them. The hills are generally low and gently sloping. Soils range from clay loams on level ground to pale brown (acidic) clay loams and loams on the hills. Red sandy clay contains granules of magniferous iron ore.

Climate Conditions are warm and humid, with a mean annual rainfall of 2800mm, most of which falls between June and September. April and May are the warmest months, and December and January are the coolest (Sarker and Fazlul Huq, 1985).

Vegetation Comprises tropical evergreen and semi-evergreen forests (Sarker and Fazlul Huq, 1983). The flora is very rich (Mountfort and Poore, 1968).

Fauna Five species of primate are present, namely slow loris *Nycticebus coucang*, rhesus macaque *Macaca mulatta*, pig-tailed macaque *M. nemestrina*, capped langur *Presbytis pileata* and dusky langur *P. phayrei*. Other mammals include jackal *Canis aureus*, Indian muntjac *Muntiacus muntjak*, wild boar *Sus scrofa*, porcupine *Hystrix indica* and black-naped hare *Lepus nigricollis* (Sarker and Fazlul Huq, 1985). Capped langur, leopard *Panthera pardus* (T), muntjac and several species of squirrel were numerous, at least one tiger *Panthera tigris* (E) was recorded, sambar *Cervus unicolor* were occasionally seen, and it was in this region that the Asiatic golden cat *Felis temmincki* (I) was sighted during the Second World Wildlife Fund Expedition to Pakistan (Mountfort and Poore, 1968). Dhole *Cuon alpinus* (V) and at least one species of bear are also reported to have been present (Olivier, 1979).

The primary forest harboured a great variety of birds, including kalij pheasant *Lophura leucomelana*, red junglefowl *Gallus gallus*, scarlet-breasted trogon *Trogon* sp. and many species of pigeons, barbets, sunbirds, flycatchers and flowerpeckers (Mountfort and Poore, 1968).

Reptiles include Indian Python *Python molurus* (V) (Sarker and Fazlul Huq, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities There is a rest house belonging to the Forest Department.

Scientific Research and Facilities No information

Conservation Value The sanctuary contains the last remaining patch of primary forest in the Sylhet region. Even this has been considerably reduced in extent since 1967 (Olivier, 1979), when some 2,072-2,590ha within Kalenga (Tarap Hill) Forest Reserve were originally recommended for total protection as a wildlife sanctuary. The rest of this forest reserve was under teak monoculture (Mountfort and Poore, 1968). By 1978, primary forest existed only in Compartment 8 (1,036ha) (Olivier, 1979).

Conservation Management No information

Management Constraints No information

Staff No information

Budget No information

Local Addresses No information

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Date May 1987, updated August 1990

SUNDARBANS EAST, WEST AND SOUTH WILDLIFE SANCTUARIES

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.03.01 (Bengalian Rainforest)

Geographical Location The three wildlife sanctuaries lie on disjunct deltaic islands in the Sundarbans Forest Division of Khulna District, close to the border with India and just west of the main outflow of the Ganges, Brahmaputra and Meghna rivers. Sundarbans West lies between the Raimangal and Malancha rivers at 2142'-2147'N, 8912'-8918'E; Sundarbans South, including Putney Island, lies between the Malancha and Kunga rivers at 2144'-2155'N, 8919'-8928'E; and Sundarbans East consists of that portion of Compartment 6 lying between the Katka and Supati Khals (creeks) at 2150'-2157'N, 8945'-8950'E. All three sanctuaries are bounded to the south by the Bay of Bengal.

Date and History of Establishment All three wildlife sanctuaries were established in 1977 under the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974, having first been gazetted as forest reserves in 1875. The entire Sundarbans is reserved forest, established under the Forest Act, 1927.

Area	Sundarbans West	9,069ha
	Sundarbans South	17,878ha
	Sundarbans East	5,439ha

A proposed extension to Sundarbans East would enlarge its total area to 18,538ha (Blower, 1985). Sundarbans National Park (133,010ha), a World Heritage Site, lies to the west in India but is not contiguous with Sundarbans West Wildlife Sanctuary in Bangladesh.

Land Tenure State

Altitude Ranges from sea level to 3m.

Physical Features The Sundarbans, covering some 10,000 sq.km of land and water, is part of the world's largest delta (80,000 sq.km) formed from sediments deposited by three great rivers, the Ganges, Brahmaputra and Meghna, which converge on the Bengal Basin (Seidensticker and Hai, 1983). The total area of the Bangladesh Sundarbans is 5,771 sq.km, of which 4,071 sq.km is land and the rest water (Christensen, 1984).

The land is moulded by tidal action, resulting in a distinctive physiography. The whole area is intersected by an intricate network of interconnecting waterways, of which the larger channels of often a mile or more in width run in a generally north-south direction. Innumerable small khals drain the land at each ebb. Rivers tend to be long and straight, a consequence of the strong tidal forces and the clay and silt deposits which resist erosion. Easily eroded sands collect at the river mouths and form banks and chars, which are blown into dunes above the high-water mark by the strong south-west monsoon. Finer silts are washed out into the Bay of Bengal but, where

they are protected from wave action, mud flats form in the lee of the dunes. These become overlain with sand from the dunes, and develop into grassy middens. This process of island building continues for as long as the area on the windward side is exposed to wave action. With the formation of the next island further out, silt begins to accumulate along the shore of the island and sand is blown or washed away (Seidensticker and Hai, 1983). Apart from Baleswar River, which flows into the Bay of Bengal just east of Sundarbans East Wildlife Sanctuary, the waterways carry little freshwater as they are cut off from the Ganges, the outflow of which has shifted from the Hooghly-Bhagirathi channels in India progressively eastwards since the 17th century. They are kept open largely by the diurnal tidal flow (Seidensticker and Hai, 1983).

Alluvial deposits are geologically very recent and deep. The soil is a silty clay loam with alternate layers of clay, silt and sand. The surface is clay except on the seaward side of islands in the coastal limits, where sandy beaches occur. In the eastern part of the Sundarbans the surface soil is soft and fertile, whereas it is harder and less suitable for tree growth in the west (Choudhury, 1968). The pH averages 8.0 (Christensen, 1984).

Climate Rainfall is heavy and humidity high (80%) due to the proximity of the Bay of Bengal. About 80% of the rain falls in the monsoon, which lasts from June to October. Mean annual rainfall varies from about 1800mm at Khulna, north of the Sundarbans, to 2790mm on the coast. There is a six-month dry season during which evapotranspiration exceeds precipitation. Conditions are most saline in February-April, the depletion of soil moisture being coupled with reduced freshwater flow from upstream. Temperatures rise from daily minima of 2-4°C in winter to a maximum of about 43°C in March and may exceed 32°C in the monsoon. Storms are common in May and October-November and may develop into cyclones, usually accompanied by tidal waves of up to 7.5m high (Seidensticker and Hai, 1983). Climatic data for Khulna are summarised by Christensen (1984).

Vegetation The mangroves of the Sundarbans are unique when compared to non-deltaic coastal mangrove forest. Unlike the latter, the Rhizophoraceae are of only minor importance and the dominant species are sund'ri *Heritiera fomes*, from which the Sundarbans takes its name, and gewa *Excoecaria agallocha*. The reason for this difference is the large freshwater influence in the north-eastern part and the elevated level of the ground surface. The Sundarbans can be classified as moist tropical seral forest, comprising a mosaic of beach forest and tidal forest (Champion, 1936). Of the latter, there are four types: low mangrove forests, tree mangrove forests, salt-water *Heritiera* forests and freshwater *Heritiera* forests. Choudhury (1968), on the basis of water salinity, recognises three zones. Sundarbans East falls within the freshwater zone, which is dominated by *H. fomes*. Gewa occurs in varying amounts, and passur *Xylocarpus moluccensis* and kankra *Bruguiera gymnorhiza* occur in more frequently flooded areas. The understory comprises singra *Cynometra ramiflora* on dry soils, amur *Amoora cucullata* on moister soils and goran *Ceriops decandra* especially in the more saline areas. Sundarbans South lies in the moderately salt-water zone, in which *Excoecaria agallocha* is dominant. It is mixed with *Heritiera* and has a dense understory of *Ceriops*. *Xylocarpus* is more frequent in this zone. Sundarbans West occurs within the salt-water zone, which supports sparse *E. agallocha*, a dense understory of *Ceriops*, and dense patches of hantal palm *Phoenix paludosa* on drier soils. Dhundal and passur *Xylocarpus* spp., and *Bruguiera* occur sporadically throughout the area. Sund'ri and gewa cover most of the Sundarbans but *Oryza coarctata*, *Nypa fruticans* and *Imperata cylindrica* are prevalent on mud flats (Khan, 1986). Large stands of keora *Sonneratia apetala* are found on newly accreted mudbanks and provide important wildlife habitat (R.E. Salter, pers. comm., 1987).

An account of the flora of the mangrove forest of the Ganges-Brahmaputra delta is given by Prain (1903). Seidensticker and Hai (1983) report a total of 334 plant species, representing 245 genera, present in the Bangladesh portion of the delta, and list principal woody and herbaceous species. Chaffey and Sandom (1985) provide a detailed list of trees and shrubs in the Bangladesh portion. Islam (1973) provides an account of the algal flora of the mangroves.

Fauna The Sundarbans is the only remaining habitat in the lower Bengal Basin for a great variety of faunal species. The presence (or former presence) of at least 40 mammal species has been documented (Sarker, 1986). Of these, no less than five spectacular species, namely Javan rhinoceros *Rhinoceros sondaicus* (E), water buffalo *Bubalus bubalis* (E), swamp deer *Cervus duvauceli* (E), gaur *Bos gaurus* (V) and probably hog deer *Axis porcinus* have become locally extirpated since the beginning of this century (Salter, 1984). The only primate is rhesus macaque *Macaca mulatta*, considered by Blower (1985) to number in the region of 40,000 to 68,200, based on surveys by Hendrichs (1975) and Khan (1986), respectively, as compared to the much higher estimate of 126,220 derived by Gittins (1981).

The Sundarbans of Bangladesh and India support one of the largest populations of tiger *Panthera tigris* (E), with an estimated 350 in that of the former (Hendrichs, 1975). Again, Gittins' estimate of 430-450 tigers may be over-optimistic (see Blower, 1985). Spotted deer *Cervus axis*, estimates of which vary between 52,600 (Khan, 1986) and 80,000 (Hendrichs, 1975), and wild boar *Sus scrofa*, estimated at 20,000 (Hendrichs, 1975), are the principal prey of the tiger, which also has a notorious reputation for man-eating. Of the three species of otter, smooth Indian otter *Lutra perspicillata*, estimated to number 20,000 (Hendrichs, 1975), is domesticated by fishermen and used to drive fish into their nets (Seidensticker and Hai, 1983). Other mammals include three species of wild cat, *Felis bengalensis*, *F. chaus* and *F. viverrina*, and Gangetic dolphin *Platanista gangetica*, which occurs in some of the larger waterways. Species accounts and a check-list are given by Salter (1984).

The varied and colourful bird-life to be seen along its waterways is one of the Sundarbans' greatest attractions. Over 270 species have been recorded (Scott, 1989), including about 95 species of waterfowl (Scott, 1989) and 38 species of raptors (Sarker, 1985b). Among the many which may be readily seen by the visitor are no less than nine species of kingfisher, including brown-winged and stork-billed kingfishers, *Pelargopsis amauroptera* and *P. capensis*, respectively; the magnificent white-bellied sea-eagle *Haliaeetus leucogaster* which, at a density of one individual per 53.1km of waterways (Sarker, 1985), is quite common; also the much rarer grey-headed fish eagle *Ichthyophaga ichthyaetus*, Pallas's fish-eagle *Haliaeetus leucoryphus* and several other raptors. Herons, egrets, storks, sandpipers, whimbrel, curlew and numerous other waders are to be seen along the muddy banks and on the chars or sandbanks which become exposed during the dry season. There are many species of gulls and terns, especially along the coast and the larger waterways. Apart from those species particularly associated with the sea and wetlands, there is also a considerable variety of forest birds such as woodpeckers, barbets, shrikes, drongos, mynahs, minivets, babblers and many others (Salter, 1984). Further details of the avifauna are given by Scott (1989).

Some 45 reptile species and 11 of amphibians have been recorded (Sarker, 1986). Of these mugger *Crocodylus palustris* (V) is now extinct, probably as a result of past over-exploitation, although it still occurs in at least one location nearby (R.E. Salter, pers. comm., 1987). Estuarine crocodile *C. porosus* (E) still survives but its numbers have been greatly depleted through hunting and trapping for skins. There are also three species of monitor, *Varanus bengalensis*,

V. flavescens and *V. salvator*, and Indian python *Python molurus* (V). Five species of marine turtle, namely loggerhead *Caretta caretta* (V), green *Chelonia mydas*, hawksbill *Eretmochelys imbricata*, olive ridley *Lepidochelys olivacea* and leatherback *Dermochelys coriacea*, have been recorded from Bangladesh waters in the Bay of Bengal and are reported to occur along the Sundarbans coast. River terrapin *Batagur baska* (E) is also present. The eighteen recorded snake species include king cobra *Ophiophagus hannah* and spectacled cobra *Naja naja*, three vipers and six sea-snakes (Salter, 1984).

Over 120 species of fish are reported to be commonly caught by commercial fishermen in the Sundarbans (Seidensticker and Hai, 1983). According to Mukherjee (1975) only brackish water species and marine forms are found in the Indian Sundarbans, freshwater species being totally absent. This may be assumed to apply also to the Bangladesh Sundarbans, except possibly in the eastern portion where there is freshwater in Baleswar River. Mention should also be made of mud-skippers or gobys which occur in large numbers and are a characteristic feature of mangrove swamps.

Crustacea account for by far the largest proportion of animal biomass, with an estimated 40 million kg of fiddler crabs and 100 million kg of mud crabs (Hendrichs, 1975). The nutrient-rich waters of the Sundarbans also yield a considerable harvest of shrimps, prawns and lobsters. The area supports a varied insect population including large numbers of honey-bees, honey and beeswax being among the economically important products. It appears, however, that the insect life of the Sundarbans has so far been little studied.

Cultural Heritage There is archaeological evidence of earlier human occupation on the deltaic islands. The human settlements are indicative of the former presence of abundant freshwater, both from the Ganges and from non-saline ground water. Human occupation ceased in the 17th century, reportedly due to pirate attacks (Christensen, 1984).

Local Human Population There are no villages in the Sundarbans, but it provides a livelihood at certain seasons of the year for an estimated 300,000 people, working variously as wood-cutters, fishermen, and gatherers of honey, golpatta leaves (*Nipa fruticans*) and grass. Fishermen come in their boats from as far away as Chittagong and establish temporary encampments at various sites along the coast, where they remain until the approach of the monsoon season in April before returning to their homes. Apart from the large numbers of people employed by contractors in the commercial exploitation of sund'ri and other tree species, the local people are themselves dependent on the forest and waterways for such necessities as firewood, timber for boats, poles for house-posts and rafters, golpatta leaf for roofing, grass for matting, reeds for fencing and fish for their own consumption. The season for collecting honey and wax is limited to two and a half months commencing annually on 1 April. Thousands of people, having first obtained their permits from the Forest Department, enter the forest in search of bee nests which are collected and then crushed to extract the honey and wax. The total quantity of these commodities collected during the 1983 season was 232 tonnes, which at a market price of 30 Tk (US\$ 1) per ser (approximately 0.9 kg) represents an appreciable source of income to local communities (Blower, 1985).

Visitors and Visitor Facilities Few tourists visit the Sundarbans due to the difficulty and cost of arranging transport and to the lack of suitable accommodation and other facilities. The area has no potential for mass tourism but it does offer obvious possibilities for limited special-interest tourism from October to April or May. The use of launches equipped with catering and sleeping

facilities is considered more practicable than permanent land-based facilities and would provide greater flexibility. There is, however, a large well-equipped rest house belonging to the Port Authority at Hiron Point, Sundarbans South Wildlife Sanctuary, and a smaller one belonging to the Forest Department at Katka in Sundarbans East Wildlife Sanctuary (Blower, 1985).

Scientific Research and Facilities Considerable research has been carried out on the Sundarbans ecosystem and its wildlife. A three-month field study of tiger, concentrating on the problem of man-eating, and other vertebrates and invertebrates, was undertaken by Hendrichs (1975) in 1971. Other faunal surveys include those of Gittins (1981) and Khan (1986) for rhesus macaque, Khan (1986) for spotted deer, Sarker and Sarker (1986) for birds, and Sarker (1985a, 1985b) and Sarker and Sarker (1985) for birds of prey. Further details of wildlife studies and surveys can be found in a synopsis compiled by Salter (1984).

Conservation Value The mangrove forests of the Sundarbans are among the richest and most extensive in the world. The Bangladesh portion, covering 6% of total land area, represents over half of the country's remaining natural forest. The forests and waterways support a wide range of fauna, including a number of species threatened with extinction. As one of the most biologically productive of all natural ecosystems, it is of great economic importance as a source of timber, fish and numerous other products (Blower, 1985).

Of the three wildlife sanctuaries, Sundarbans East appears to be most valuable in terms of diversity of habitat and scenic attraction but is considered too small to be effective. It is unclear whether or not the small island known locally as Putkadya, about 2km offshore, is included within this sanctuary but it should be in view of its suitability as habitat for waders and as a nesting site for marine turtles. Sundarbans West and Sundarbans South would seem to be of adequate size (Blower, 1985).

Conservation Management Sundarbans East is administered from offices at Katka and Tiger Point, and Sundarbans South from Hiron Point. No office has yet been established within Sundarbans West. There are no recognised local rights within the reserved forest, entry and collection of forest produce being subject to permits issued by the Forest Department. The Department may issue hunting licences under the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974, but in practice none is issued and the whole Sundarbans is thus effectively closed to legal hunting. Under the provision of this Act, various activities are prohibited within the wildlife sanctuaries, including *inter alia* residence, cultivation of land, damage to vegetation, hunting, introduction of domestic animals and setting of fires. Any of these prohibitions may be relaxed, however, for scientific purposes, aesthetic enjoyment or "improvement" of scenery (Blower, 1985).

The Sundarbans has been the subject of a series of successively more comprehensive working plans since its declaration as reserved forest, the most recent of which points out the importance of the tiger in controlling the spotted deer population, and also mentions the intention of establishing compartments 3-7 as a 'game sanctuary', a total area of some 52,320ha (Choudhury, 1968). In the event, when Sundarbans East was eventually established it included only a part of Compartment 6, only one-tenth of the area originally proposed. A likely explanation is that the recommended areas contain high-quality timber relative to that gazetted, indicating that Sundarbans East was chosen on the basis of its unimportance to forestry, rather than value to wildlife. Sundarbans South and West may have been selected for the same reason, as timber within both sites is of lower quality (Olivier, 1979). A plan relating specifically to wildlife

conservation was prepared under the joint sponsorship of the World Wildlife Fund and the National Zoological Park, Smithsonian Institution (Seidensticker and Hai, 1983). Emphasis is directed towards managing the tiger, together with all wildlife, as an integral part of forest management that assures the sustainable harvesting of forest products and maintains this coastal zone in a way that meets the needs of the local human population. The Sundarbans Forest Development Planning Mission, carried out by FAO in conjunction with the Bangladesh Forest Department in February-May 1984, collected all available data related to the use and management of forest products, wildlife and fisheries, assessed development potential and prepared proposals for further integrated development and conservation of the natural resources of the area (Christensen, 1984; Salter, 1984). More recently, Blower (1985) reviewed wildlife conservation in the Sundarbans Reserved Forest as part of the Sundarbans Forest Inventory Project, carried out by the Bangladesh Forest Department and the Land Resources Development Centre of the UK Overseas Development Administration. The main purpose of the project is to provide the necessary data on which to base future exploitation of the forest for sustainable use of timber, fuelwood and other forest produce, with due consideration to wildlife conservation and the social amenity value of the area. It has been recommended that the Sundarbans be managed as a single unit with full protection afforded to both wildlife and habitat in the wildlife sanctuaries, and with forest resources exploited at sustainable levels but wildlife protected elsewhere in the reserved forest. The establishment of intermediate buffer zones, in which disturbance is kept to a minimum through restriction of access, is recommended in areas peripheral to sanctuary boundaries. A new working plan is due to be prepared, based on data collected by the project, and is expected to include detailed prescriptions concerning the conservation and management of the sanctuaries (Blower, 1985). Formulation of a strategy and integrated plan for the sustained multiple-use, conservation and management of natural resources in the Sundarbans Reserved Forest is due to commence shortly with funding from UNEP (Project: BGD/84/056/A/01/12).

Management Constraints A long-term ecological change is taking place in the Sundarbans, due to the eastward migration of the Ganges, abandonment of some distributaries, diversion of water and withdrawals for irrigation. (Up to 40% of the dry season flow of the Ganges has been diverted upstream, following the completion of the Farraka Barrage in India in 1974.) Decreased freshwater flushing of the Sundarbans results in increased saline intrusion, particularly in the dry season. Concern has been expressed about recent indications of apparent deterioration in the flora, including localised die-back of sund'ri, commercially the most valuable of tree species. Top-dying of sund'ri is most likely associated with the decrease in freshwater flow, either as a direct effect of increasing salinity or other associated edaphic changes. A gradual replacement of *Heritiera* with *Excoecaria*, therefore, is a likely long-term effect (Christensen, 1984). While deterioration in the vegetation is already well-documented (International Engineering Company, 1977, 1980) and is the subject of continuing study, no attention has yet been given to the possible effects which these changes might have on the fauna. It is perhaps significant, however, that the stocking of spotted deer appears lower in western areas, where salinity is highest, than in the east where it is lowest. Oil spills are another potential threat and could cause immense damage, especially to aquatic fauna and seabirds and probably also to the forest itself (Blower, 1985).

Cyclones and tidal waves cause some damage to the forest along the sea-face, and are reported to result occasionally in considerable mortality among spotted deer. The most immediate threat is over-exploitation, both of timber resources, which may have already taken place, and also of the fauna. Agricultural encroachment has already occurred to a limited extent on the eastern and western boundaries and, with increasing population pressure in surrounding settled areas, could reach serious proportions unless checked. Fishermen's camps are a major source of

disturbance. There is extensive hunting and trapping, not only by fishermen and woodcutters but also reportedly by naval and military personnel from Hiron Point in Sundarbans South Wildlife Sanctuary (Blower, 1985). A total of 118 offences was recorded and over 3,300m of deer nets removed between 1981/82 and 1986/87 (Habib, 1989). The capture of adult marine turtles and *Batagur* in fishing nets and their subsequent killing and marketing for food is a potentially serious problem (R.E. Salter, pers. comm., 1987).

The Sundarbans has been notorious for its man-eating tigers since the 17th century. Numbers of reported deaths has varied from 0 to 47 (mean = 22.1) per annum during the period 1947-1983 (R.E. Salter, pers. comm., 1987). In 1988, 65 deaths were reported during a four-month period (*The Guardian*, 28 December 1988). Noting that tigers that hunt man like any other prey occurred only in the south and west, Hendrichs (1975) hypothesised on a possible linkage between high salinity levels, due to the absence of freshwater, and man-killing. This is not substantiated by more recent analyses, which suggest that man-killing may be at least partly correlated with the availability of easy prey (humans) and the frequency of man-tiger interactions (Salter, 1984; Siddiqi and Choudhury, 1987).

Staff Sundarbans East: one deputy ranger, one forest guard; Sundarbans South: one forest ranger, two forest guards; Sundarbans West: one deputy ranger, one forest guard. Staff are responsible for the protection of the sanctuaries but, in practice, they are involved primarily with collection of revenue and other normal Forest Department duties (Blower, 1985).

Budget No information

Local Addresses Assistant Conservator of Forests, Sundarbans East Wildlife Sanctuary, Sarankhola, Khulna District; Assistant Conservator of Forests, Sundarbans South Wildlife Sanctuary, Nalianala, Khulna District; Range Officer, Sundarbans West Wildlife Sanctuary, Burigoalini, Khulna District

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TEKNAF GAME RESERVE

IUCN Management Category VIII (Multiple Use Management Area)

Biogeographical Province 4.04.01 (Burman Rainforest)

Geographical Location Lies 80km south of Cox's Bazaar in the Teknaf Peninsula of south-eastern Bangladesh. Stretches from Thinkhali in the north to Teknaf township in the south, all of which is within Cox's Bazaar Forest Division. 21°00'N, 92°20'E

Date and History of Establishment Teknaf is a reserved forest which was declared a game reserve in 1983 under the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974. It includes an area formerly referred to as the Thainkhali Game Reserve (7,770ha) (Government of Bangladesh, 1973).

Area 11,615ha

Land Tenure State

Altitude Ranges from 5m to 700m.

Physical Features The terrain is rugged, with undulating hills aligned in a north-to-south direction and bordering the Bay of Bengal to the west. Soils on the hills are predominantly pale brown (acidic) clay loams and loams developed from shales and siltstones. Perennial water courses, known as 'charas', in the forested hilly areas are the only dependable source of water for elephants in the vicinity.

Climate Moist tropical maritime conditions prevail, with a mean annual rainfall of 4060mm and mean humidity of 81.2% (Khan and Rashid, 1983).

Vegetation Comprises evergreen and semi-evergreen secondary forests, which have regenerated following clear-felling, and teak *Tectona grandis* plantations. The tropical wet evergreen forest is characterised by chapalish *Artocarpus chaplasha*, telsur *Hopea odorata*, chundul *Tetrameles nudiflora*, pitraj *Amoora wallichii*, uriam *Mangifera longipes*, civit *Swintonia floribunda*, toon *Toona ciliata* and jam *Syzygium* spp. It is now confined to deep valleys and shaded slopes with good water supplies. The dense multi-storeyed semi-evergreen forest, typical of the peninsula, ranges in height from 20m to 45m. The top canopy, which includes several deciduous species, is characterised by baitta garjan *Dipterocarpus scaber*, telya garjan *D. turbinatus*, dulya garjan *D. alatus*, koroi *Albizia procera*, chukka k'oroi *A. chinensis*, chapalish, uriam, civit, shimul *Bombax ceiba* and *B. insignis*, bandarholla *Duabanga grandiflora* and narikeli *Sterculia alata*. The second storey is dominated by evergreens, such as batna *Quercus* sp., jam, *Castanopsis* sp., jarul *Lagerstroemia speciosa*, bena *Macaranga denticulata*, kamdeb *Calophyllum polyanthum*, hargoza *Dillenia pentagyna*, dharmara *Pterospermum personatum*, moos *P. paniculata*, *Sterculia villosa*, *S. colorata*, konak *Schima wallichii*, nageshwar *Mesua ferrea*, bahera *Terminalia bellerica*, haritaki *T. chebula*, champa *Michelia champaca*, gamar *Gmelina arborea* and bot *Ficus* spp. Saplings predominate below the second storey, together with adaliya *Meliosmapinnata*, naricha *Musaramentacea*, dormala *Callicarpa arborea*, goda *Vitex glabrata*, kestoma and kechua *Glochidion* spp., sheora *Streblus asper*, jalpai *Elaeocarpus* spp. and bela *Semicarpus anacardium*. The undergrowth of both evergreen and semi-evergreen forests is dominated by bamboo, the commonest species being muli *Melocannia bambusoides*, mitenga *Bambusa tulda*, kaliserri *Oxytenanthera auriculata*, daloo *Teinostachyum dulooa* and orah *Dendrocalamus longispathus* (Khan and Rashid, 1983).

Fauna Teknaf Peninsula still has quite a rich fauna. Moreover, it provides a vital refuge for elephant *Elephas maximus* (E), estimated in 1982-1983 to number 101, of which 71 resided within an area of 55,000ha and the rest came from the Arakan area of Burma (Reza Khan and Rashid, 1983). Other mammals include rhesus macaque *Macaca mulatta*, capped langur *Presbytis pileata*, Hoolock gibbon *Hylobates hoolock* (V), sloth bear *Melursus ursinus* (I), hog-badger *Arctonyx collaris*, crab-eating mongoose *Herpestes urva*, civets (Viverridae), small

cats *Felis* spp., flying squirrel *Petaurista* sp. and Malayan giant squirrel *Ratufa bicolor* (Khan, 1985a). Ungulates present in that part of the park which used to be known as Thainkhali Game Reserve include Indian muntjac *Muntiacus muntjak*, sambar *Cervus unicolor* and wild boar *Sus scrofa* (Olivier, 1979). Leopard *Panthera pardus* (T) and possibly dhole *Cuon alpinus* (V) are also present (Olivier, 1979).

The avifauna is diverse and includes kalij pheasant *Lophura leucomelana*, fruit pigeons, hornbills and woodpeckers (Khan, 1985a).

Reptiles include Malayan box turtle *Cuora amboinensis*, uncommon in Bangladesh, Indian python *Python molurus* (V) and monitor *Varanus* sp. (Khan, 1985a).

Cultural Heritage No information

Local Human Population There are 25-30 villages within the forests of the Peninsula and some 50 villages on their peripheries. Local people, who are largely dependent on forest resources for their livelihood, grow rice, millet, vegetables and pan in the valleys (Khan and Rashid, 1983).

Visitors and Visitor Facilities The reserve has potential for tourism, particularly since Cox's Bazaar, renowned as being the only health resort in the country, is a tourist centre (Khan and Rashid, 1983). There are two rest houses in the vicinity, at Inoni and Teknaf (Olivier, 1979).

Scientific Research and Facilities The elephant population was studied between May 1982 and April 1983 (IUCN/WWF Project 3038) and a management strategy developed to conserve the species (Khan and Rashid, 1983).

Conservation Value Teknaf Peninsula contains the most important tracts of evergreen and semi-evergreen forests in south-eastern Bangladesh (Khan and Rashid, 1983) and about one third of the country's total elephant population, estimated at 300 animals (Khan, 1985b). The Peninsula is also an important wetland site (Scott, 1989), although the wetlands themselves lie outside the reserve.

Conservation Management The reserve was established to protect the elephant population, but the Forest Department continues its operations in the area. Preliminary recommendations for elephant management include: replacing clear-felling with selective felling; replanting cleared areas with indigenous species of trees; establishing corridors to facilitate movement of elephants and other wildlife between cleared areas; and controlling encroachment, grazing by livestock and extraction of bamboo (Khan and Rashid, 1983).

Management Constraints There has been considerable pressure on minor forest products from the coastal people who either fished or grew pan *Piper betle*. Removal of the forest understorey, to meet local demands for timber, firewood and bamboo, has interfered with natural regeneration. Large areas of forest have been turned into plantations (teak) and, since 1976, Burmese refugee camps have had a severe local impact on forests (Womersley, 1979). Most accessible areas on the Peninsula have been clear-felled or subjected to shifting cultivation, with the result that little virgin forest remains. Regeneration is hindered, due to the pressure of livestock and other forms of disturbance, and the vegetation is changing towards a drier scrub-forest or savannah, characterised by sungrass *Imperata cylindrica*, bhat *Clerodendrum infortunatum*, *Lantana*

camara, *Eupatorium odoratum*, *Melostoma* sp. and others. The main elephant food, bamboo, has largely been extracted and replaced by unpalatable plants, such as *Lantana* and *Eupatorium*. This has probably been responsible for the increased raiding of crops, particularly by solitary elephants. Oil palm has recently been introduced to a 4,000ha area but is damaged by migratory elephants and, to a much greater extent, by porcupines. In 1978-1983, over 400ha of forested land was encroached by villagers with the authority of the Forest Department and others. Bamboo is extracted at an estimated rate of 10,000 canes per week, and some 8,000 cattle and water buffalo are taken daily into the forests for grazing, except possibly from January to April (Khan and Rashid, 1983).

Staff Forest guards

Budget No information

Local Addresses No information

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Date May 1987, updated August 1990

INDIA

Area 3,166,830sq.km

Population 835,000,000 (1989) Natural Increase 2.2% per annum

GNP US\$ 300 per capita (1987)

Policy and Legislation A commitment to protect and enhance the environment is enshrined within India's Constitution (Forty-Second Amendment) Act, 1977, as follows:

"The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country." (Article 48A); and

"It shall be the duty of every citizen of India ... (g) to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures." (Article 51A).

There is no provision, however, which enables the union government to enact legislation pertaining to environmental issues that is uniformly applicable to all states and union territories. In addition to the separate federal and state jurisdiction, there exists a concurrent list of legislative powers which, since 1976, includes *inter alia* forests and the protection of wild animals and birds. The concurrent list gives over-riding power to the federal government but executive authority lies with the state governments (Dwivedi and Kishore, 1984). The constitutional directives have provided a strong basis for the enactment of legislative measures for environmental protection. The need to integrate environmental considerations with economic development was explicitly articulated for the first time in the 4th Five-Year Plan, 1969-1974 (Biswas and Bannerjee, 1984). There is no statutory requirement for environmental impact assessment at present but a mechanism has been initiated whereby assessment is an integral part of the planning process, with appraisals of major projects being the responsibility of the Department of Environment, Forests and Wildlife (Dwivedi and Kishore, 1984). Among the recommendations of the Tiwari Committee, a high-powered committee appointed by the government in February 1980 to suggest administrative and legislative reforms to improve environmental protection in the country, was the introduction of environment protection in the concurrent list of the Constitution.

The National Environment Policy envisages conservation and development, as well as equity among the people sharing the environment, but these tend to be mutually incompatible under much of the existing legislation (Singh, 1985). India is in the process of formulating a national conservation strategy.

The protection of wildlife has a long tradition in Indian history. Wise use of natural resources was a prerequisite for many hunter-gatherer societies which date back to at least 6000 BC. The

most notable of such traditions are sacred groves, totally inviolate to any human interference, and village groves where only limited use by members of the community is permitted. Many of these are still in existence. Extensive clearance of forests accompanied the advance of agricultural and pastoral societies in subsequent millennia, but an awareness of the need for ecological prudence emerged and many so-called pagan nature conservation practices were retained (Gadgil, 1989). Among the earliest provisions for the establishment of protected areas are those codified in the *Arthashastra*, India (321-300 BC), written by Kautilya, reputedly the Prime Minister of King Chandra Gupta Maurya. Prescriptions included rules for the administration and management of forests, and provisions for three classes of forests, namely those reserved for the king, those allocated for ascetics and those for the public which could be used only for hunting purposes. Kautilya is also the first-recorded person to have advocated the creation of 'Abhayaranyas', or sanctuaries for wildlife. The following century, during the reign of Emperor Ashoka, the first-recorded conservation measures for wildlife were enacted, and reserves were established for wild animals (Singh, 1986; Mitra, 1989). Hindu, Moslem and, latterly, British rulers continued these traditions in subsequent centuries, setting up reserves for privileged hunting over much of India. As more and more land became settled or cultivated, so these hunting reserves increasingly became refuges for wildlife. Many of these reserves were subsequently declared as national parks or sanctuaries, mostly after Independence in 1947. Examples include Gir in Gujarat, Dachigam in Jammu & Kashmir, Bandipur in Karnataka, Evarikulam in Kerala, Madhav (now Shivpuri) in Madhya Pradesh, Simlipal in Orissa, and Keoladeo, Ranthambore and Sariska in Rajasthan. The fact that the great majority of the Indian population is vegetarian (devout Hindus and Jains) has undoubtedly helped to preserve that part of India's natural heritage which remains today (Singh, 1985; Gadgil, 1989).

Following Independence, a number of states (Goa, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Mysore, Punjab, Rajasthan and Tamil Nadu) enacted wildlife preservation acts, while others (Assam, Uttar Pradesh and West Bengal) continued to enforce the Government of India Wild Birds and Animals Protection Act, 1912. National park acts were enacted by a few states but only five national parks were established under these acts, namely Kanha, Bandhavgarh and Shivpuri in Madhya Pradesh, Tarora in Maharashtra and Hailey (now Corbett) in Uttar Pradesh. The Hailey National Park Act of 1936 was probably the first law in India intended for the exclusive protection of wildlife and its habitat (IBWL, 1970; Kothari *et al.*, 1989).

A National Wildlife Policy for India was first formulated by an Expert Committee of the Indian Board for Wildlife in 1970 (IBWL, 1970). A major aim was to reserve at least 4% of the total land area for wildlife, both plants and animals - an objective which has recently been exceeded. Much of this policy was subsequently enshrined in the Wild Life (Protection) Act, 1972. The Act provides the necessary uniform legislation for the establishment of protected areas and has since been adopted by all states and union territories. Provisions include *inter alia* the constitution of state wildlife advisory boards and the notification of sanctuaries, national parks, game reserves and closed areas by state governments. A sanctuary is defined as an area of "adequate ecological, faunal, floral, geomorphological, natural or zoological significance." Setting up a sanctuary involves settling all private rights, either allowing them to continue or acquiring them after adequate compensation. Hunting, entry with any weapon, causing fire, and using substances potentially injurious to wildlife are prohibited, while fishing and grazing by livestock may be allowed on a controlled basis. Permission to enter or reside in a sanctuary may be granted by the Chief Wildlife Warden for purposes of photography, scientific research, tourism and transaction of lawful business with any person residing in a sanctuary. A national

park is defined similarly to a sanctuary. Similar provisions apply but hunting and cattle grazing are prohibited. In addition, exploitation or removal of any wildlife, or its habitat, is prohibited within a national park. Moreover, only a completely unencumbered area, in which all rights have become vested in the state government, can be declared as a national park. Once established, its boundaries may not be altered except through a resolution passed by the state legislature. A game reserve is an area in which only licensed hunting is permitted, and a closed area is one which is closed to hunting for such periods as may be specified in the notification. State-owned land leased or otherwise transferred to Central Government may be declared as a sanctuary or national park by the federal authority.

The basis to present nature conservation policy in India is the National Wildlife Action Plan (Department of Environment, n.d.). Drawing on the World Conservation Strategy launched by IUCN in March 1980, the Bali Action Plan arising from the 3rd World Parks Congress in October 1982 and the World Charter for Nature adapted and proclaimed by the United Nations General Assembly in October 1982, it was adopted by the Government of India in October 1983 on the recommendation of the Indian Board for Wildlife. Objectives include the establishment of a representative network of protected areas and development of appropriate management systems (together with the restoration of degraded habitats), and the adoption of a National Conservation Strategy.

The Indian Forest Act, first enacted in 1865 and succeeded by a more comprehensive act in 1927, provides significant protection to wildlife through the provision for reserved and protected forests to be established in any forest or waste lands belonging to the government, or over which the government has proprietary rights. Some states enacted their own forest legislation after the National Forest Policy was announced in 1952, while others amended the Act to suit their own requirements. Activities prohibited within reserved forests include: making fresh clearings or breaking up land for cultivation; kindling or carrying fire; trespass and cattle grazing; felling or otherwise damaging any tree; quarrying stone, burning lime or charcoal; removing forest produce; and hunting, shooting, fishing, trapping and poisoning water. In general, activities prohibited within reserved forests are subject to regulations in protected forests. In addition, in protected forests, any trees, class of trees or portion of forest may be temporarily closed to all forms of exploitation, including the quarrying of stone and burning of lime. The Act also makes provision for the rights of government over land constituted as reserved or, in the case of a few states, protected forest to be assigned to village communities. Such village forests are subject to all provisions of the Act that relate to reserved (or protected) forests. The Forest (Conservation) Act was promulgated in 1980 to stem the indiscriminate diversion of forest land to non-forestry purposes. Under this Act, no forest land can be de-reserved or diverted to non-forestry purposes without the approval of Central Government. Other initiatives include a moratorium, imposed since 1983, on the felling of trees at altitudes of 1,000m and above (Ministry of Forests and Wildlife, 1985). The 1952 National Forest Policy was superceded by a new National Forest Policy (Resolution No. 3-1/86 FP) on 7 December 1988. Objectives include the maintenance of environmental stability, conserving the nation's natural heritage by preserving remaining natural forests, preventing soil erosion and denudation of catchment areas, and creating a mass people's movement with the involvement of women to achieve such aims and minimise pressure on existing forests. A target has been set for one-third of the total land area of the country to be under forest, as originally stipulated in the 1952 National Forest Policy, but in the hills and mountainous regions the target is two-thirds. In addition, forest management must provide 'corridors' to link protected areas and thereby maintain genetic continuity between artificially

separated subpopulations of migrant wildlife. Also, full protection of the rights and concessions of tribals and poor people dependent on forests is advocated (Government of India, 1988).

A selected list of other environmental legislation is given in *A Second Citizen's Report* (CSE, 1985). Of particular note is the Environment (Protection) Act, 1986, which provides a focus for environmental issues in the country and plugs loopholes in the existing legislation (Ministry of Environment and Forests, 1987a).

Inadequacies in the existing nature conservation legislation are reviewed by Dwivedi and Kishore (1984) and by Singh (1986). The recognition of only wild animals and birds, without reference to plants, is an important omission from both the Wild Life (Protection) Act and the Constitution. Uniform and comprehensive forest legislation is urgently needed, with emphasis on forest conservation rather than the existing system of resource exploitation. Both acts are currently under revision.

International Activities India ratified the Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) on 14 November 1977. Five natural sites have been inscribed on the World Heritage List to date, namely Kaziranga, Keoladeo, Sundarbans and Nanda Devi national parks and Manas Sanctuary.

India acceded to the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) on 1 October 1981, at which time Chilka Lake and Keoladeo National Park were designated as wetlands of international importance. Four more sites (Harike, Logtak, Sambhar and Wular lakes) were designated on 23 March 1990.

Participation in the Unesco Man and Biosphere Programme began in 1972 with the constitution of the Indian National MAB Committee. The Indian Biosphere Reserves Programme will operate within the ambit of existing state and federal legislation; separate legislation for biosphere reserves is not envisaged (Ministry of Environment and Forests, 1987b). Thirteen potential biosphere reserves have been identified, of which the Nilgiri Biosphere Reserve is the first to have been established but has yet to be nominated for inclusion in the international biosphere reserve network.

Administration and Management The Department of Environment, Forests and Wildlife within the Ministry of Environment and Forests was created in September 1985. It serves as the administrative focus within Central Government for planning, promoting and coordinating environmental and forestry programmes, including the preservation and protection of wildlife and the biosphere reserve programme (Ministry of Environment and Forests, 1987a). Previously, wildlife management was the responsibility of the Forest Department within the Ministry of Agriculture. Following recommendations made by the Tiwari Committee, a separate Department of Environment was constituted on 1 November 1980 to which wildlife management was transferred in September 1982. This Department became part of a new Ministry of Environment and Forests, constituted under Presidential Notification No. 74/2/1/85-Cab. dated 4 January 1985. At that time, the Ministry consisted of two departments, namely Environment and Forests & Wildlife, but these were merged later that year (Government of India, n.d.; Ministry of Environment and Forests, 1986, 1987a). Departments of environment have also been set up in a number of states (Biswas and Bannerjee, 1984).

Wildlife, together with forestry, has traditionally been managed under a single administrative organisation within the forest departments of each state or union territory, with the role of Central Government being mainly advisory. There have been two recent developments. Firstly, the Wild Life (Protection) Act has provided for the creation of posts of chief wildlife wardens and wildlife wardens in the states to exercise statutory powers under the Act. This has largely been responsible for the creation of wildlife wings within each state headed by a chief wildlife warden. Under this Act, it is also mandatory for the states to set up state wildlife advisory boards. Secondly, the inclusion of protection of wild animals and birds in the concurrent list of the Constitution, has provided the Centre with some legislative control over the states in the conservation of wildlife (Pillai, 1982). Guidelines specifying that the management of protected areas should be under the remit of the wildlife wings were issued by Central Government in 1975, but progress in implementing them was slow. This prompted Central Government to threaten cessation of financial assistance to states which had not transferred protected areas to their respective wildlife wings. The situation has since improved, all states and union territories with national parks or sanctuaries having set up wildlife wings. However, by 1987, three states (Andhra Pradesh, Punjab and Tamil Nadu) had not transferred control over any protected area to their respective wildlife wings, while eight others (Bihar, Gujarat, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Uttar Pradesh and West Bengal) had transferred only some of their national parks and sanctuaries (Ministry of Environment and Forests, 1987a; Kothari *et al.*, 1989). Management of protected areas in individual states and union territories is summarised by Pillai (1982).

The Indian Board for Wildlife under the chairmanship of the Prime Minister, is the main advisory body to the Government of India on wildlife matters. First constituted in 1952 as the Central Board for Wildlife, it was later re-designated as the Indian Board for Wildlife. Among its various achievements, it has been instrumental in the formulation of the Wild Life (Protection) Act, the establishment of many new protected areas (including tiger reserves), and in the formation of separate departments for wildlife conservation both at the Centre and in the states. State wildlife advisory boards have been constituted under statutory provisions of the Wild Life (Protection) Act to advise state governments (Saharia and Pillai, 1982).

The administration of Project Tiger, initiated as a Central Sector Scheme in 1973, is overseen by a Steering Committee headed by the Minister of State for Environment and Forests. The Director is responsible for coordinating the Project within Central Government. Execution of the Project is the responsibility of the chief conservators of forests in the relevant states, with tiger reserves managed by field directors. The Project's present status is that of a centrally-sponsored scheme, with costs shared equally between the union and state governments (Panwar, 1982).

Training in wildlife management is undertaken at the Wildlife Institute of India, which became an autonomous institution of the Ministry of Environment and Forests with effect from 1 April 1986. Its objectives include training in protected areas management, research and extension services, building a computerised wildlife information system, and providing advisory services. The Institute offers a one-year post-graduate diploma course for forest officers, a three-month certificate course for forest rangers and an M.Sc. Wildlife Biology course (WII, 1987).

There are many non-governmental organisations involved in nature conservation. The oldest is the Bombay Natural History Society, established in 1883 and currently comprising about 3,000 members. Whereas work undertaken in its early years was concentrated on collecting, ident-

ifying and documenting India's flora and fauna, the emphasis has shifted to conservation-oriented research in recent decades, particularly threatened species and habitats. Long-term field studies are based in a number of protected areas, such as Keoladeo National Park (Rajasthan), Mudumalai Sanctuary (Tamil Nadu) and Dalma Sanctuary (Bihar). The Society's *Journal of the Bombay Natural History Society* is widely circulated in India and overseas.

World Wide Fund for Nature-India (formerly World Wildlife Fund-India), established in 1969, has quickly developed to become the largest non-governmental nature conservation organisation in India, with 20 branches and a total staff of about 130. Its activities include ecological research and surveys, policy reviews, conservation projects, nature education and responsibility to the Ministry of Environment and Forests for environmental information relating to federal and state legislatures, NGOs and the media. Two recent initiatives underway are the establishment of the Indira Gandhi Conservation Monitoring Centre and the launch of a Community Biodiversity Conservation Movement.

The Indian National Trust for Art and Cultural Heritage, constituted in January 1984, has rapidly emerged as one of the most progressive and influential conservation bodies in India. It has 150 regional chapters spread over India's 32 states and union territories, the ultimate goal being to establish a chapter in each district. Its aim is to develop an awareness among the public of India's cultural and natural heritage and to promote its conservation. The Trust set up a Natural Heritage Cell in May 1985 which promotes land-use planning and management in areas of critical conservation importance.

The Centre for Science and Environment aims to publicise topical environmental issues, as well as promoting people's participation in environmentally-sound rural development. Its findings are documented in its citizens' reports, two of which have been published to date (CSE, 1982, 1985).

Other national conservation organisations include the Wildlife Preservation Society of India, founded in 1958 and publisher of the journal *Cheetal*. Another is the Indian Society of Naturalists, which publishes *Environmental Awareness*. Details of some 700 environmental non-governmental organisations can be found in a directory produced by WWF-India.

Protected areas are often poorly managed, with little consideration given to the local people living in and around them (Singh, 1986). The legal, ecological and management status of protected areas has recently been examined by the Environment Studies Division, Indian Institute of Public Administration (Kothari *et al.*, 1989). The study was commissioned by the National Committee on Environmental Planning in 1984 and sponsored by the Ministry of Environment and Forests. The survey shows, for example, that only 40% of 52 national parks and 8% of 209 sanctuaries have completed legal procedures for their establishment. Only 43% of national parks and 28% of sanctuaries surveyed have management plans; in many cases they are cursory documents and have never been approved by the state government. Many of the deficiencies in protected areas management reflect a lack of commitment of resources on the part of state governments. For example, in 1983-84, expenditure on protected areas was 1.5% of forest department budgets. The Environmental Studies Division is currently engaged in a series of in-depth studies of management issues in a selection of India's major protected areas.

Systems Reviews India is a nation of extraordinary diversity, the seventh largest and second most populous in the world. Its relief can be conceptualised in terms of three well-defined

regions: the Himalayan mountain system along its northern margin; the Gangetic Plain, which extends some 2,400km from Assam in the east to the Punjab in the west and southwards to the Rann of Kutch in Gujarat; and the Deccan Plateau which is flanked on either side by the Western Ghats and Eastern Ghats (Mani, 1974). Its rich diversity of ecosystems, which range from tropical rain forests to deserts, and from marine and coastal systems to high mountains, support an estimated 5-8% of the world's known flowering plant and animal species, of which a significant proportion are endemic (Gadgil and Meher-Homji, 1986). Important centres of biological diversity, particularly for plants, are the Western Ghats, north-eastern India and the Andaman and Nicobar Islands (Nayar, 1989).

Forest once covered most of India but much of it has been destroyed or severely degraded as a result of human population pressures, particularly in the fertile lowlands which are among the most densely populated areas in the world. For example, 4.1 million hectares of forest were cleared mainly for agriculture between 1951 and 1980 (Vedant, 1986; Singh, 1986). Probably less than 1% of the total land area is covered by primary forest (Mani, 1974). Forests are estimated to have covered 64.01 million hectares in 1985-1987, or 19.5% of total land area comprising 11.5% dense forest (at least 40% crown density), 7.8% open forest (at least 10% crown density) and 0.1% mangrove forest (FSI, 1989).

The total area of wetlands (excluding rivers) in India is 58,286,000ha, or 18.4% of the country, 70% of which comprises areas under paddy cultivation. A total of 1,193 wetlands, covering an area of 3,904,543ha, were recorded in a preliminary inventory coordinated by the Department of Science and Technology, of which 572 were natural. In a recent review of India's wetlands, 93 are identified as being of conservation importance (Scott, 1989).

Coral reefs occur along only a few sections of the mainland, principally the Gulf of Kutch, off the southern mainland coast, and around a number of islands opposite Sri Lanka. This is due largely to the presence of major river systems and the sedimentary regime on the continental shelf. Elsewhere, corals are also found in the Andaman, Nicobar and Lakshadweep groups, although their diversity is reported to be lower than in south-east India (UNEP/IUCN, 1988).

Historically, conservation in India stems mainly from the creation of large forest reserves in the late 19th and early 20th centuries to safeguard timber, soil and water resources. Superimposed on this network of reserved forests has been a much smaller number of national parks and sanctuaries where the value of the biological resource has persuaded authorities to reduce the level of forest product utilisation (Rodgers, 1985). Both the adoption of a National Policy for Wildlife Conservation in 1970 and the enactment of the Wild Life (Protection) Act in 1972 lead to significant growth in the protected areas network. The network was further strengthened by a number of national conservation projects, notably Project Tiger, initiated on 1 April 1973 by the Government of India with support from WWF (IBWL, 1972; Panwar, 1982), and the Crocodile Breeding and Management Project, launched on 1 April 1975 with technical assistance from UNDP/FAO (Bustard, 1982). Project Tiger has been acclaimed as an internationally outstanding conservation success story. Its achievements and shortcomings are reviewed by Panwar (1984) and Singh (1986). More recently, the Government of India has initiated a Snow Leopard Conservation Scheme along the lines of Project Tiger, but with the emphasis on resolving conflicts between wildlife and resident human populations without having to relocate villagers from within protected areas (Ministry of Environment and Forests, 1987a).

In fulfillment of one of the major objectives of the National Wildlife Action Plan (Department of Environment, n.d.), the existing protected areas system has been reviewed and plans formulated for a comprehensive network which covers the full range of biological diversity in the country (Rodgers and Panwar, 1988). In mid-1987, there were 426 national parks and sanctuaries covering a combined area of 109,652 sq.km, or 3.3% of the country. Major gaps in the network included inadequate representation (1%) of the following biotic provinces: Ladakh, South Deccan, Gangetic Plains, Assam Hills and Nicobars. Recommendations in the review bring the total number of protected areas to 651, covering 151,342 sq.km or 4.6% of the country. Particular emphasis is given to protecting sites of high species diversity and endemism, as well as ecologically fragile areas. These proposals supercede previous recommendations emanating from the Corbett Action Plan (IUCN, 1985) and the IUCN systems review of the Indomalayan region (Mackinnon and Mackinnon, 1986). They also endorse the earlier work of Gadgil and Meher-Homji (1986), in which representation of the main vegetation types of India within the protected areas network is assessed. A number of states are now implementing many of the recommendations made in the protected areas plan, to the extent that total coverage by national parks and sanctuaries now exceeds 4%.

Addresses

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Chief Wildlife Warden, ITANAGAR, Arunachal Pradesh 791 111

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 Chief Wildlife Warden, PO Sanjenthong, IMPHAL, Manipur 795 001
 Chief Wildlife Warden, Risa Colony, SHILLONG, Meghalaya 793 003
 Chief Wildlife Warden, AIZAWAL, Mizoram 796 001
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Summary of Protected Areas of India

<i>National/International designation</i> Name of area	IUCN Management category	Area (ha)	Year notified
<i>Ramsar Wetlands</i>			
Keoladeo National Park	II	2,873	1972
<i>World Heritage Sites</i>			
Kaziranga National Park	X	42,996	1985
Keoladeo National Park	X	2,873	1985
Manas Wildlife Sanctuary	X	39,100	1985
Nanda Devi National Park	X	63,033	1982
Sundarbans National Park	X	133,010	1984

ANDAMAN AND NICOBAR ISLANDS UNION TERRITORY

<i>National Parks</i>			
Marine (Wandur)	II	28,150	1983
Middle Butten Island	II	65	1979
Mount Harriet Island	II	4,622	1979
North Butten Island	II	44	1979
Saddle Peak	II	3,255	1979
South Butten Island	II	4	1979
<i>Sanctuaries</i>			
Arial Island	IV	5	1987
Bamboo Island	IV	5	1987
Barren Island	IV	810	1977
Battimalve Island	IV	223	1985
Belle Island	IV	8	1987
Benett Island	IV	346	1987
Bingham Island	IV	8	1987
Blister Island	IV	26	1987
Bluff Island	IV	114	1987
Bondoville Island	IV	255	1987
Brush Island	IV	23	1987
Buchanan Island	IV	933	1987
Chanel Island	IV	13	1987
Cinque Island	IV	951	1987
Clyde Island	IV	54	1987
Cone Island	IV	65	1987
Crocodile (Lohabarrack)	IV	10,600	1983
Curlew (B.P.) Island	IV	16	1987
Curlew Island	IV	3	1987
Defence Island	IV	1,049	1987
Dot Island	IV	18	1987

Dottrel Island	IV	13	1987
Duncan Island	IV	73	1987
East (Inglis) Island	IV	355	1987
East Island	IV	611	1987
Egg Island	IV	5	1987
Entrance IslandS	IV	96	1987
Flat Island	IV	936	1987
Gander Island	IV	5	1987
Goose Island	IV	1	1987
Gurjan Island	IV	16	1987
Hump Island	IV	47	1987
Interview Island	IV	13,300	1985
James Island	IV	210	1987
Jungle Island	IV	52	1987
Kwangtung Island	IV	57	1987
Kyd Island	IV	800	1987
Landfall Island	IV	2,948	1987
Latouche Island	IV	96	1987
Mangrove Island	IV	39	1987
Mask Island	IV	78	1987
Mayo Island	IV	10	1987
Megapode Island	IV	13	1985
Montgomery Island	IV	21	1987
Narcondum Island	IV	681	1977
North Brother Island	IV	75	1987
North Island	IV	49	1987
North Reef Island	IV	348	1977
Oliver Island	IV	16	1987
Orchid Island	IV	10	1987
Ox Island	IV	13	1987
Oyster Island-1	IV	8	1987
Oyster Island-2	IV	21	1987
Paget Island	IV	736	1987
Parkinson Island	IV	34	1987
Passage Island	IV	62	1987
Patric Island	IV	13	1987
Peacock Island	IV	62	1987
Pitman Island	IV	137	1987
Point Island	IV	307	1987
Potanma Island	IV	16	1987
Ranger Island	IV	426	1987
Reef Island	IV	174	1987
Roper Island	IV	146	1987
Ross Island	IV	101	1987
Rowe Island	IV	1	1987
Sandy Island	IV	158	1987
Sea Serpent Island	IV	78	1987
Shark Island	IV	60	1987
Shearme Island	IV	785	1987

Sir Hugh Rose Island	IV	106	1987
Sisters Island	IV	36	1987
Snake Island-1	IV	3	1987
Snake Island-2	IV	73	1987
South Brother Island	IV	124	1987
South Reef Island	IV	117	1987
South Sentinel Island	IV	161	1977
Spike Island-1	IV	42	1987
Spike Island-2	IV	1,170	1987
Stoat Island	IV	44	1987
Surat Island	IV	31	1987
Swamp Island	IV	409	1987
Table (Delgarno) Island	IV	229	1987
Table (Excelsior) Island	IV	169	1987
Talabaicha Island	IV	321	1987
Temple Island	IV	104	1987
Tillanchong Island	IV	1,683	1985
Tree Island	IV	3	1987
Trilby Island	IV	96	1987
Tuft Island	IV	29	1987
Turtle Island	IV	39	1987
West Island	IV	640	1987
Wharf Island	IV	11	1987
White Cliff Island	IV	47	1987

Subtotal		81,650	
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ANDRA PRADESH STATE

Sanctuaries

Coringa	IV	23,570	1978
Eturnagaram	IV	81,259	1953
Kawal	IV	89,228	1965
Kinnersani	IV	63,540	1977
Kolleru	IV	90,100	1963
Lanjamadugu	IV	3,620	1978
Manjira	IV	2,000	1978
Nagarjunasagar Srisailam	IV	35,689	1978
Neelapattu	IV	453	1976
Pakhal	IV	86,205	1952
Papikonda	IV	59,068	1978
Pocharam	IV	12,964	1952
Pranhita	IV	13,603	1980
Pulicat	IV	58,000	1976
Rollapadu	IV	614	1988
Siwaram	IV	2,992	1978
Srivenkateswara	IV	50,700	

Subtotal		673,605	
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ARUNACHAL PRADESH STATE*National Parks*

Mouling	II	48,300	1986
Namdapha	II	198,524	1983

Sanctuaries

D'Ering Memorial	IV	19,000	1978
Itanagar	IV	14,030	1978
Mehao	IV	28,150	1980
Pakhui	IV	86,195	1977

Subtotal		394,199	
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ASSAM STATE*National Parks*

Kaziranga	II	42,996	1974
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Sanctuaries

Barnadi	IV	2,622	1980
Dipor Beel	IV	4,000	1989
Garampani	IV	600	1952
Laokhowa	IV	7,014	1979
Manas	IV	39,100	1928
Nameri	IV	13,707	1985
Orang	IV	7,260	1985
Pabha	IV	4,900	
Pobitora	IV	3,883	1987
Sonai Rupai	IV	17,500	1934

Subtotal		143,582	
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BIHAR STATE*National Parks*

Palamau	II	21,300	1986
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Sanctuaries

Bhimbandh	IV	68,190	1976
Dalma	IV	19,322	1976
Gautam Budha	IV	25,948	1976
Hazaribagh	IV	18,625	1976
Kabar	IV	20,400	1986
Kaimur	IV	134,222	1978
Koderma	IV	17,795	1985
Lawalang	IV	21,103	1978
Mahuadaur	IV	6,325	1976
Nagi Dam	IV	209	1983
Nakti Dam	IV	20,640	1985
Palamau	IV	76,700	1976
Parasnath	IV	4,923	1984

Rajgir	IV	3,584	1978
Topchanchi	IV	875	1978
Udaipur	IV	874	1978
Valmikinagar	IV	46,160	1978
Subtotal		507,195	

CHANDIGARH UNION TERRITORY

<i>Sanctuaries</i>			
Sukhna	IV	2,542	
Subtotal		2,542	

DELHI UNION TERRITORY

<i>Sanctuaries</i>			
Indira Priyadarshini	IV	1,320	
Subtotal		1,320	

GOA STATE

<i>National Parks</i>			
Bhagwan Mahavir	II	10,700	1978
<i>Sanctuaries</i>			
Bhagwan Mahavir	IV	14,852	1967
Bondla	IV	800	1969
Chorao	IV	180	1988
Cotigao	IV	10,500	1968
Subtotal		37,032	

GUJARAT STATE

<i>National Parks</i>			
Bansda	II	2,399	1976
Gir	II	25,871	1975
Marine (Gulf of Kutch)	II	16,289	1982
Velavadar	II	3,408	1976
<i>Sanctuaries</i>			
Barda	IV	19,931	1979
Dumkhal	IV	44,818	1982
Gaga	IV	333	1987
Gir	IV	115,342	1965
Hingolghadh	IV	654	1980
Jessore	IV	18,066	1978
Kachchh Desert	IV	750,622	1986
Khijadiya	IV	605	1981

Marine (Gulf of Kutch)	IV	29,303	1986
Nal Sarovar	IV	12,082	1969
Narayan Sarovar	IV	76,579	1981
Rampura	IV	1,501	1988
Ratanmahal	IV	5,565	1982
Wild Ass	IV	495,370	1973

Subtotal		1,618,738	
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HARYANA STATE

Sanctuaries

Bhindawas	IV	513	1986
Bir Shikargah	IV	1,093	1975
Chautala	IV	11,396	1987
Chhilchhila	IV	43	1986
Nahar	IV	212	1987
Sultanpur	IV	121	1971

Subtotal		13,378	
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HIMACHAL PRADESH STATE

National Parks

Great Himalayan	II	60,561	1984
Pin Valley	II	80,736	1987

Sanctuaries

Bandli	IV	3,947	1962
Chail	IV	11,004	1976
Churdhar	IV	5,659	1985
Daranghati	IV	2,701	1962
Darlaghat	IV	9,871	1962
Gangul Siya-Behi	IV	10,546	1949
Gobind Sagar	IV	12,067	1962
Kalatop & Khajjiar	IV	3,069	1949
Kanawar	IV	6,157	1954
Khokhan	IV	1,760	1954
Kias	IV	1,220	1954
Kugti	IV	33,000	1962
Lippa Asrang	IV	2,953	1962
Majathal	IV	3,164	1962
Manali	IV	3,127	1954
Naina Devi	IV	3,719	1962
Nargu	IV	24,313	1962
Pong Dam	IV	32,270	1983
Raksham Chitkul	IV	3,827	1962
Renuka	IV	478	1964
Rupi Bhabha	IV	85,414	1982
Sechu Tuan Nala	IV	65,532	1962

Shikari Devi	IV	7,119	1962
Shilli	IV	202	1963
Simbalbara	IV	1,720	1958
Simla Water Catchment Area	I	951	1958
Talra	IV	3,616	1962
Tirthan	IV	6,825	1976
Tundah	IV	41,948	1962

Subtotal		531,255	
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JAMMU & KASHMIR STATE

National Parks

City Forest	Unassigned	907	
Dachigam	II	14,100	1981
Hemis High Altitude	II	410,000	1981
Kishtwar	II	31,000	1981

Game Reserves

Bohu	Unassigned	1,974	1981
Boodhkharbu Chakar	Unassigned	1,200	1981
Brain	Unassigned	1,870	
Chashul Wetland	Unassigned	1,500	1981
Daksum	Unassigned	5,000	
Dara	Unassigned	3,000	
Gaurana Wetland	Unassigned	80	1981
Honlei Wetland	Unassigned	700	1981
Hygam	Unassigned	1,400	
Jawahar Tunnel	Unassigned	1,799	1981
Kanji	Unassigned	10,000	1981
Khangurd	Unassigned	4,910	
Khirram	Unassigned	2,800	
Khrew	Unassigned	4,410	
Kokarian Wetland	Unassigned	2,023	1981
Koritaroh	Unassigned	1,166	
Limber	Unassigned	1,200	
Lung Nag	Unassigned	40,000	
Mirgrind Wetland	Unassigned	300	
Nadoora Wetland	Unassigned		
Nangachantar Wetland	Unassigned	1,529	1980
Noorichang Wetland	Unassigned	200	1981
Pampore-Kranchoo Wetland	Unassigned	500	
Panyar	Unassigned	1,600	
Pargawal Wetland	Unassigned	4,918	1981
Sabu Chakar	Unassigned	1,500	1981
Sangral Wetland	Unassigned	696	1981
Shallabug Wetland	Unassigned	700	1981
Shang	Unassigned	8,000	1981
Shikargah	Unassigned	2,800	
Sudh Mahadev	Unassigned	10,165	1981

Thain	Unassigned	1,889	1981
Tsomarari Wetland	Unassigned	1,000	1981
<i>Sanctuaries</i>			
Baltal	IV	20,300	1987
Changthang	IV	400,000	1987
Gulmarg	IV	18,600	1987
Hirapora	IV	11,000	1987
Hokarsar	IV	1,000	
Jasrota	IV	406	1987
Karakoram	IV	180,000	
Lachipora	IV	8,000	1987
Limber	IV	2,600	1987
Nandini	IV	3,372	1981
Overa	IV	3,237	1981
Overa-Aru	IV	42,500	1987
Ramnagar	IV	1,290	1981
Surinsar-Mansar	IV	3,958	1981
Tongri	IV	2,000	
Trikuta	IV	310	1981
Subtotal		1,275,409	

KARNATAKA STATE

<i>National Parks</i>			
Anshi	II	25,000	1987
Bandipur	II	87,420	1974
Bannerghatta	II	10,427	1974
Kudremukh	II	60,032	1987
Nagarahole	II	64,339	1975
<i>Sanctuaries</i>			
Adichuncha Nagiri	IV	84	1981
Arabithittu	IV	1,350	
Bhadra	IV	49,246	1974
Biligiri Ranga Swamy Temple	IV	32,440	1974
Brahmagiri	IV	18,129	1974
Cauvery	IV	51,051	1987
Dandeli	IV	572,907	1975
Ghataprabha	IV	2,979	1974
Melkote Temple	IV	4,982	1974
Mookambika	IV	24,700	1974
Nugu	IV	3,032	1974
Pushpagiri	IV	10,292	1987
Ranebennur	IV	11,900	1974
Ranganthittu	IV	67	1940
Sharavathi Valley	IV	43,123	1974
Shettihally	IV	39,560	1974
Someshwara	IV	8,840	1974
Talkaveri	IV	10,500	1987

Tungabadra	IV	22,422	
Subtotal		1,154,822	
KERALA STATE			
<i>National Parks</i>			
Eravikulam	II	9,700	1978
Periyar	II	30,500	1982
Silent Valley	II	8,952	1980
<i>Sanctuaries</i>			
Aralam	IV	5,500	1984
Chimony	IV	10,500	1984
Chinnar	IV	9,044	1984
Idukki	IV	7,700	1976
Neyyar	IV	12,800	1958
Parambikulam	IV	28,500	1973
Peechi Vazhani	IV	12,500	1958
Peppara	IV	5,300	1983
Periyar	IV	47,200	1950
Shenduruny	IV	10,032	1984
Thattekkad Bird	IV	2,500	1983
Wynad	IV	34,444	1973
Subtotal		285,172	
MADHYA PRADESH STATE			
<i>National Parks</i>			
Bandhavgarh	II	44,884	1968
Fossil	III	27	1983
Indravati	II	125,837	1978
Kanger Ghati	II	20,000	1982
Kanha	II	94,000	1955
Madhav	II	15,615	1959
Panna	II	542,666	1981
Pench	II	29,286	1977
Sanjay	II	193,801	1981
Satpura	II	52,437	1981
Van Vihar	Unassigned	445	1979
<i>Sanctuaries</i>			
Achanakmar	IV	55,155	1975
Badalkhol	IV	10,435	1975
Bagdara	IV	47,890	1978
Barnawapara	IV	24,466	1976
Bhairamgarh	IV	13,895	1983
Bori	IV	51,825	1977
Gandhi Sagar	IV	36,862	1974
Ghatigaon Great Indian Bustard	IV	51,200	1981

Gomarda	IV	27,782	1972
Karera Great Indian Bustard	IV	20,221	1981
Ken Gharial	IV	4,500	1981
Kheoni	IV	12,270	1982
Narsingarh	IV	5,719	1974
National Chambal	IV	42,300	1978
Noradehi	IV	118,696	1975
Pachmarhi	IV	46,086	1977
Palpur (Kuno)	IV	34,468	1981
Pamed	IV	26,212	1983
Panpatha	IV	24,584	1983
Pench	IV	11,847	1977
Phen	IV	11,024	1983
Ratapani	IV	68,879	1976
Sailana	IV	1,296	1983
Sanjay (Dubri)	IV	36,459	1975
Sardarpur	IV	34,812	1983
Semarsot	IV	43,036	1978
Singhori (Sindhari)	IV	28,791	1976
Sitanadi	IV	55,336	1974
Son Gharial	IV	4,180	1981
Tamor Pingla	IV	60,852	1978
Udanti	IV	24,759	1983
Subtotal		2,154,835	

MAHARASHTRA STATE

National Parks

Gugamal	II	36,180	1987
Nawegaon	II	13,388	1975
Pench	II	25,726	1975
Sanjay Gandhi	II	8,696	1983
Tadoba	II	11,655	1955

Sanctuaries

Andhari	IV	50,900	1986
Aner Dam	IV	8,294	1986
Bhimashankar	IV	13,100	1985
Bor	IV	6,110	1970
Chandoli	IV	30,900	1985
Chapralla	IV	13,500	1986
Gautala Autram	IV	26,100	1986
Great Indian Bustard	IV	849,644	1979
Jaikwadi	IV	34,105	1986
Kalsubai Harishchandragad	IV	36,200	1986
Karnala	IV	448	1968
Katepurna	IV	1,500	
Koyna	IV	42,400	1985
Malvan	IV	2,912	1987

Melghat	IV	159,733	1985
Nagzira	IV	15,281	1969
Nandur Madmeshwar	IV	10,010	1986
Painganga	IV	32,462	1986
Phansad	IV	7,000	1986
Radhanagari	IV	37,200	1958
Rehekuri	IV	217	1980
Sagareshwar	IV	1,100	1985
Tansa	IV	30,481	1970
Yawal	IV	17,752	1969

Subtotal **1,522,994**

MANIPUR STATE

National Parks

Keibul Lamjao	II	4,000	1977
Sirohi	II	4,130	1982

Sanctuaries

Yagoupokpi Lokchao	IV	18,480	1989
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Subtotal **26,610**

MEGHALAYA STATE

National Parks

Balphakram	II	22,000	1986
Nokrek	II	6,801	1985

Sanctuaries

Bagmara	IV	2	1984
Nongkhyllem	IV	2,900	1981
Siju	IV	518	1979

Subtotal **32,221**

MIZORAM STATE

Sanctuaries

Dampa	IV	68,100	1985
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Subtotal **68,100**

NAGALAND STATE

Sanctuaries

Fakim	IV	642	1983
Intanki	IV	20,202	1975
Puliebadze	IV	923	1979

Rangapahar	IV	470	1986
Subtotal		22,237	

ORISSA STATE*National Parks*

North Simlipal	II	84,570	1978
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Sanctuaries

Balimela	IV	16,000	
Balukhand	IV	7,200	1984
Bhitar Kanika	IV	17,000	1975
Chandaka Dampada	IV	22,000	1982
Chilka	IV	1,553	1987
Debrigarh	IV	34,690	1985
Hadgarh	IV	19,160	1978
Kapilasa	IV	12,600	1970
Karlapat	IV	25,500	1969
Khalasuni	IV	11,600	1982
Kondakameru	IV	43,000	
Kotgarh	IV	39,950	1981
Kuldiha	IV	27,275	1984
Lakhari	IV	11,835	1985
Mahanadi Baisipalli	IV	16,835	1981
Nandankanan	Unassigned	1,402	1979
Saptasajya	IV	2,000	1970
Satkosia Gorge	IV	79,552	1976
Simlipal	IV	135,500	1978
Sunabeda	IV	44,213	1983
Ushakothi	IV	30,403	1987

Subtotal		683,838	
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PUNJAB STATE*Sanctuaries*

Abohar	IV	18,824	1975
Bir Bunerheri	IV	829	1952
Bir Gurdial Pura	IV	847	1977
Bir Motibagh	IV	524	1952
Harike Lake	IV	4,300	1982

Subtotal		25,324	
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RAJASTHAN STATE*National Parks*

Desert	II	316,200	1981
Keoladeo	II	2,873	1981

Ranthambore	II	39,200	1980
Sariska	II	27,380	1982
<i>Sanctuaries</i>			
Bandh Baretha	IV	19,276	1985
Bassi	IV	15,290	
Bhensrodgarh	IV	22,914	1983
Darrah	IV	26,583	1955
Jaisamand	IV	5,200	1956
Jamwa Ramgarh	IV	30,000	1982
Jawahar Sagar	IV	10,000	1980
Keladevi	IV	67,600	1983
Kumbhalgarh	IV	57,826	1971
Mount Abu	IV	28,884	1960
Nahargarh	IV	5,000	1980
National Chambal	IV	28,000	1983
Phulwari	IV	51,141	1983
Ramgarh Bundi	IV	30,700	1982
Sanjjangarh	IV	519	1987
Sariska	IV	49,200	1958
Sawai Mansingh	IV	10,325	1984
Shergarh	IV	9,871	1983
Sita Mata	IV	42,294	1979
Sunda Mata	IV	10,700	
Tal Chapar	IV	710	1962
Todgarh Raoli	IV	49,527	1983
Van Vihar	IV	5,993	1955
Subtotal		963,206	

SIKKIM STATE*National Parks*

Khangchendzonga	II	84,950	1977
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Sanctuaries

Fambong Lho	IV	5,160	1984
Kyongnosla	IV	401	1984
Maenam	IV	3,534	1987
Singba	IV	3,250	1984

Subtotal		97,295	
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TAMIL NADU STATE*National Parks*

Guindy	Unassigned	271	1976
Indira Gandhi	II	11,808	1989
Marine (Gulf of Mannar)	II	623	1986

Sanctuaries

Anamalai	IV	84,935	1976
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Kalakad	IV	22,358	1976
Karikili	IV	61	
Mudumalai	IV	32,155	1940
Mukurthi	IV	7,846	1982
Mundanthurai	IV	56,738	1962
Point Calimere	IV	1,726	1967
Pulicat	IV	46,102	1980
Srivilliputhur	IV	48,520	1988
Vedanthangal	IV	30	1925
Vettangudi	IV	13	1977

Subtotal **313,186**

TRIPURA STATE

Sanctuaries

Gumti	IV	38,954	1988
Roa	IV	858	1988
Sepahijala	IV	1,853	1987
Trishna	IV	17,056	1987

Subtotal **58,721**

UTTAR PRADESH STATE

National Parks

Corbett	II	52,082	1936
Dudwa	II	49,029	1977
Nanda Devi	I	63,033	1982
Rajaji	II	83,153	1988
Valley of Flowers	II	8,950	1982

Sanctuaries

Askot	IV	600	1986
Binsar	IV	4,559	1988
Chandra Prabha	IV	7,800	1957
Govind Pashu Vihar	IV	95,312	1954
Hastinapur	IV	2,073	1986
Kaimur	IV	50,075	1982
Katarniaghat	IV	40,009	1976
Kedarnath	IV	97,524	1972
Kishanpur	IV	22,712	1972
Mahavir Swami	IV	540	1977
National Chambal	IV	63,500	1979
Nawabganj	IV	225	1984
Ranipur	IV	23,031	1977
Samaspur	IV	799	198
Sohagabarwa	IV	42,820	1987
Sonanadi	IV	30,118	1987

Subtotal **737,944**

WEST BENGAL STATE*National Parks*

Neora Valley	II	8,689	1986
Singalila	II	7,860	1986
Sundarbans	I	133,010	1984

Sanctuaries

Ballavpur	Unassigned	202	1977
Bethuadahari	IV	120	1980
Bibhutibhusan	IV	64	1980
Buxa	IV	31,452	1986
Chapramari	IV	960	1976
Gorumara	IV	862	1984
Halliday Island	IV	583	1976
Jaldapara	IV	11,563	1941
Lothian Island	IV	3,885	1976
Mahananda	IV	12,722	1976
Narendrapur	IV	11	1982
Parmadan	IV	198	
Raiganj	IV	128	1985
Ramnabagan	IV	14	1981
Sajnakhali	IV	36,234	1976
Senchal	IV	3,860	1976

Subtotal		252,417	
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TOTALS

National parks (% total land area)	3,524,856	(1.1%)
Sanctuaries (% total land area)	9,981,364	(3.2%)
Games reserves (% total land area)	120,829	(0.0%)

Note: Maps showing the locations of national parks and sanctuaries are presented for each state in Rodgers and Panwar (1988), and other summary data can be found in Variava and Singh (1985). No further details of Indian protected areas are given in this directory because the Environmental Studies Division, Indian Institute of Public Administration is in the process of producing a series of protected areas directories for each state. The first for Himachal Pradesh has recently been published (Kothari *et al.*, 1990), and others for the Andaman and Nicobar Islands, Gujarat and Karnataka are forthcoming.

PAKISTAN

Area 803,940 sq.km

Population 110,400,000 (1989)

Natural Increase 2.9% per annum

GNP US\$ 350 per capita (1987)

Policy and Legislation Environmental protection and ecology are included in the concurrent legislative list of Pakistan's 1973 constitution. This initiative, together with the formation of an Environment and Urban Affairs Division in 1973, was largely responsible for the enactment of the Environment Protection Ordinance, 1983. The Ordinance is a landmark in Pakistan's legislation and represents official recognition of a holistic approach to environmental issues (Mumtaz, 1989). It provides for the control of pollution and preservation of a comprehensive national environmental policy, and filing of detailed environmental impact statements by proponents of projects likely to adversely affect the environment. The main drawback of the Ordinance, however, is its much narrower scope - focussing on anti-industrial pollution - than was envisaged in the original draft, which included legal provisions for the protection of Pakistan's natural resource base (Mumtaz, 1989).

A significant step towards meeting the environmental challenge was taken in 1988, with the support of IUCN, by initiating the National Conservation Strategy development process. A secretariat has been set up in the Environment and Urban Affairs Division (Ministry of Housing and Works), which reports to a high-level steering committee comprising representatives of eight ministries directly concerned with natural resources, and five from the private sector. The NCS development process represents an unique policy review of economic issues and their collective impacts on the environment. Public consultations are an integral part of this review and planning exercise (Kabiraji, 1986; Mumtaz, 1989). As part of the review process, a national workshop was held in 1986 (IUCN/GOP, 1987). The first phase of the development process, namely the formulation of Pakistan's NCS, was completed in 1990 (JRC, n.d.).

Early Hindu and Muslim rulers, recognising the inadvisability of uncontrolled hunting, were the first to set aside game reserves wherein hunting was restricted during breeding seasons. By the late 16th century, the Mughals had codified regulations pertaining to hunting and these policies were adopted by succeeding Sikh and British administrations (ALIC, 1981). Indiscriminate exploitation of forest resources during the 19th century led to the realisation of the need for a forest policy. Although not of direct relevance to Pakistan, the first forest policy directive issued by the Government of India was in the form of a Memorandum (3 August 1855) for the protection and extraction of teak. It restricted the rights of forest dwellers to conserve the forests. Government of India Circular No.22-F (19 October 1894) represented a more comprehensive forest policy statement, which emphasised management of forests for timber production, watershed protection and maintenance of productive capacity. It also provided guidelines on basic principles associated with rights of people living adjacent to forest lands (Mumtaz, 1989).

Among the first pieces of legislation that directly benefited wildlife were the rules and regulations formulated in Sind under the Indian Forest Act in 1887 and later incorporated in the Bombay Forest Manual. Under this legislation, forests were protected from grazing by livestock but hunting was not legally controlled. Hunting and other forms of resource exploitation were subsequently controlled within areas declared as reserved or protected forests under the Indian Forest Act, 1927, the title of which was changed to Pakistan Forest Act, 1927 following Pakistan's adoption of the act after partition in 1947 (Ferguson, 1978; Rao, 1984). The 1927 Act sought to "consolidate the law relating to forests, the transit of forest produce and the duty leviable on timber and other forest produce." It further "empowers the government to set aside forests reserves, appoint officers charged with the management of those territories, enforce rules governing the use of forests, determine the degree to which timber and other products may be exploited, and regulate the movement of cattle upon these lands. Moreover, the Act authorises the Government to punish violators of the stipulations contained in it." The 1927 Act has since been amended by the West Pakistan Goats (Restriction) Ordinance of 1959 and the West Pakistan Goats Restriction Rules of 1961, which enable the government to protect rangelands from grazing damage by goats through limiting their numbers and movements.

The 1927 Act is not conservation-oriented, commercial forestry interests being foremost. Subsequent forest policy, under the directives of 1955, 1962 and 1980, has attempted to bring forests under sound scientific management and included provisions for the creation of national parks to conserve major ecosystems, but it has not been successful (Mumtaz, 1989). The need to reassess and redefine policy is being addressed by the Forest Department, following on from a recent evaluation of Pakistan's forest policy at an international seminar organised by the Ministry of Food, Agriculture and Cooperatives in 1989.

Wildlife conservation legislation inherited from British India was superceded by the now obsolete West Pakistan Wildlife Protection Ordinance, 1959 and the West Pakistan Wildlife Protection Rules, 1960 issued under that ordinance. Apart from prohibiting the killing of certain species of fauna, this legislation made provision for the declaration of game sanctuaries, in which hunting was prohibited, and game reserves, in which hunting was controlled under license, but did not protect the habitat against settlement, cultivation, grazing and other forms of exploitation. Furthermore, both the West Pakistan Wildlife Protection Ordinance and the Pakistan Forest Act applied only to the settled areas of Pakistan (i.e. the flood plains of the Kabul and Indus rivers and all the land to the east of them); neither were applicable to the Special/Tribal Areas, which constituted most of the mountainous half of the country to the west of the Indus and where much of Pakistan's remaining wildlife was to be found (Grimwood, 1969).

A Wildlife Enquiry Committee was set up in 1968 to review *inter alia* the existing conservation legislation, based on recommendations by World Wildlife Fund (Mountfort and Poore, 1967, 1968). Legislation was drafted by this committee (Government of Pakistan, 1971) and, with minor modifications, was subsequently adopted at provincial level through the provision of various acts and an ordinance, namely: Sind Wildlife Protection Ordinance, 1972, Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974, Baluchistan Wildlife Protection Act, 1974, and North-West Frontier Province Wildlife (Protection, Preservation, Conservation and Management) Act, 1975. Separate laws were passed for the Northern Areas, Azad State of Jammu & Kashmir and Federal Capital Territory of Islamabad. These are the Northern Areas Wildlife Preservation Act, 1975, Azad Jammu and Kashmir Wildlife Act, 1975 and the Islamabad Wildlife (Protection, Preservation, Conservation and Management) Ordinance, 1979 (Rau, 1984). This is the first time in the history of Pakistan's wildlife legislation

that an attempt has been made to provide for the conservation of habitat (although limited to protected areas) and species other than game species.

All of these statutes provide for the creation and management of national parks, wildlife sanctuaries (synonymous with wildlife reserves in the Northern Areas Act), game reserves (synonymous with controlled hunting areas in the Northern Areas Act) and, in the case of the Punjab, North-West Frontier Province and Islamabad legislation, private game reserves. A national park is a comparatively large area of outstanding scenic merit and natural interest, wherein the primary objective is to protect the landscape, flora and fauna in its natural state and to which the public are allowed access for purposes of recreation, education and research. No hunting or trapping of animals or birds is permitted. Harvesting of forest produce on a sustained basis is allowed provided national park values are not jeopardised. Construction of access roads, accommodation facilities and public amenities should be carefully planned so as not to impair the primary objective of a park's establishment. A wildlife sanctuary is an area set aside as an undisturbed breeding ground, primarily for the protection of all natural resources, to which public access is prohibited or regulated. Whereas settlement and grazing by domestic livestock is allowed in national parks (see Grimwood, 1972, for a discussion of the implications arising from this aspect of the legislation), such activities are prohibited within wildlife sanctuaries. A game reserve is an area wherein controlled hunting and shooting is permitted on a permit basis. A private game reserve is an area of private land set aside by its owner for the same purpose as a game reserve. Parts of areas protected under some statutes may be denotified under pressure for agricultural extension or land development (Ullah, 1970; Government of Pakistan, 1971; Rao, 1984; Khan and Hussain, 1985). To date, there are no notified private game reserves but a number exist in Baluchistan (e.g. Goth Raisani, Serajabad, Nasirabad area) and Sind (e.g. Khairpur), where there is no legal provision for their establishment, and in Punjab (e.g. Kalabagh). Existing wildlife legislation is reviewed by Rao (1984). Model legislation (Pakistan Wildlife Protection Act) is currently being prepared by the National Council for Conservation of Wildlife (Rao, 1987).

International Activities Pakistan ratified both the Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) and the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention) on 23 July 1976. No natural sites have been inscribed to date under the World Heritage Convention. Nine wetlands were designated at the time of Pakistan's ratification of the Ramsar Convention, of which two (Kandar Dam and Kheshki Reservoir) are no longer considered to be of international importance (Scott, 1989). Pakistan participates in the Unesco Man and Biosphere Programme, but there does not appear to have been any significant development in recent years. Pakistan also participates in the South Asian Cooperative Environmental Programme.

Administration and Management Originally, the Game Department was responsible for administering the West Pakistan Wildlife Protection Ordinance up until 1967, when it was absorbed into the Forest Department (Grimwood, 1969). Following the recommendations of the Wildlife Enquiry Committee (Government of Pakistan, 1971), a National Council for Conservation of Wildlife was established on 7 July 1974 within the then Federal Ministry of Food and Agriculture. It has an advisory board, and is responsible for co-ordinating central and provincial government effort in the formulation and implementation of wildlife policies. The Inspector General of Forests is assisted by a Conservator of Wildlife, who acts as an adviser on wildlife, but the actual management of wildlife is handled by the provincial forest (wildlife) departments. Sind, Punjab and Azad State of Jammu & Kashmir have separate wildlife

administrations, but in North-West Frontier Province, Baluchistan and Northern Areas wildlife is administered by branches of the respective forest departments. In practice, forest staff look after wildlife in reserved or protected forests, and wildlife staff are responsible for protecting wildlife in other protected areas and elsewhere. In North-West Frontier Province, wildlife staff are responsible for wildlife everywhere. Within the Federal Capital Territory of Islamabad, the Directorate of Horticulture is responsible for the administration of protected areas. Legal provision has been made for the creation of wildlife management boards to approve wildlife policies and monitor development activities in Punjab, Sind, North-West Frontier Province and Islamabad. Sind has an effective wildlife management board, while those of North-West Frontier Province and Punjab are progressing. Boards exist in Baluchistan, Azad State of Jammu & Kashmir and Northern Areas but only in an advisory capacity. That for Islamabad is not yet active. Provision has also been made for the appointment of honorary officers to help implement wildlife legislation in all areas except Baluchistan and Islamabad. The idea was first introduced in Sind in the 1970s and proved to be very successful in Kirthar National Park, resulting in the recovery of markhor and other large mammal populations. It has since been adopted in Punjab and Azad State of Jammu & Kashmir, with the appointment of local dignitaries as honorary game wardens invested with considerable legal power to help enforce the law within protected areas (Ferguson, 1978; NCCW, 1978; Roberts, 1983; Rao, 1984).

The Environmental Protection Ordinance is enforced by the Pakistan Environment Protection Council, but this has not yet been formed. The Council is also responsible for establishing a national environmental policy, providing direction to conserve renewable and expendable resources and ensuring that environmental considerations are incorporated within national development plans and policies. Administration of the Ordinance is the responsibility of the Pakistan Environment Protection Agency. Provincial Environment Protection Agencies have been set up, but other implementation procedures have yet to be streamlined (Mumtaz, 1989).

Among the non-governmental organisations involved with conservation is the Pakistan Wildlife Conservation Foundation, a registered charity established in 1979. Its president is appointed by a resolution of the National Council for Conservation of Wildlife. A main objective is to promote wildlife conservation activities through provision of funds in accordance with the policies of the National Council for Conservation of Wildlife. The International Union for Conservation of Nature and Natural Resources (The World Conservation Union) has a regional office in Karachi. Field programmes concerned with protected areas management issues are focussed on Korangi/Phitti Creek in the Indus Delta, juniper forests in Baluchistan and Khunjerab National Park in the Northern Areas. World Wide Fund for Nature-Pakistan (formerly World Wildlife Fund-Pakistan) has offices in Lahore and Karachi. Two bodies are concerned specifically with promoting the conservation of pheasants, namely the World Pheasant Association (Pakistan) and the Pheasant Conservation Forum.

Emphasis on the management of national parks has been given to the development of recreation facilities for tourists rather than nature conservation as, for example, in Lal Suhanra and Margalla Hills national parks. Management categories need to be modified (Grimwood, 1972; Rao, 1984), perhaps by the introduction of nature reserves and country parks to replace wildlife sanctuaries. Protected and reserved forests continue to be managed under forest working plans after being designated national parks or wildlife sanctuaries, thereby undermining the purpose of their re-notification. Hunting in game reserves is not controlled on a sustained yield basis, permits being issued arbitrarily and subject to political influence (Rao, 1984). The Government of Punjab, however, has restricted the number of shoots under an amendment to the Punjab Wildlife

Act (Khan and Hussain, 1985). Weak enforcement of the law is an overall constraint, but also safeguards against habitat degradation within protected areas are inadequate (Rao, 1984).

Systems Reviews Predominantly arid and semi-arid, Pakistan is a land of great contrasts. Nearly 60% of the country consists of mountainous terrain and elevated plateaux; the rest is lowland, generally below 300m. The highlands comprise: the Himalaya and adjacent mountain ranges to the north, rising to 8,611m at the top of K2, the world's second highest peak; the central Sulaiman Range and its southern extensions (Ras Koh, Siahan and Kirthar ranges); and the western Baluchistan Plateau. The lowlands comprise the Indus River plain and a narrow stretch of coastline bordering the Arabian Sea.

Pakistan is poor in forests. In 1984, they comprised 1.3 million ha of productive forests and 3.0 million ha of protective forests, covering 4.8% of the country, and were estimated to be shrinking at the rate of 1% per year (Government of Pakistan, 1984). In North-West Frontier Province, however, forests are more extensive and cover 11.8% of total land area (Nawaz, 1985).

Pakistan possesses a great variety of wetlands distributed throughout much of the country. Inland waters cover 7.8 million ha, over half of which comprises waterlogged areas, seasonally flooded plains and saline wastes. Coastal mangrove swamps cover at least 260,000ha. Pakistan's wetlands are important for waterfowl, particularly those of the Indus Valley - a major wintering ground for a wide variety of central and northern Asian species, as well as being of socio-economic value (Scott, 1989).

Most of Pakistan's remaining wildlife is to be found in the mountainous country west of the Indus, where human pressure has not been as great as in the plains. The two regions of outstanding importance are the Himalayan and Karakoram massifs in the extreme north and the desert in the south-west of the country (Grimwood, 1969). To the east of the Indus, Hazara Division in North-West Frontier Province and several areas in Punjab have a considerable amount of wildlife (M.M. Malik, pers. comm., 1987), as does the Neelum Valley in Azad State of Jammu & Kashmir (G. Duke, pers. comm., 1990). Wildlife resources and their exploitation have been reviewed for Baluchistan (Roberts, 1973; Mian and O'Gara, 1987; Groombridge, 1988) and Sind (Roberts, 1972). Major irrigation systems, built to tap the water resources of the Indus and its tributaries to meet the demands of an increasing human population, have resulted in the disappearance of extensive tracts of the original tropical thorn scrub, riverine swamp and forest in the plains (Roberts, 1977). In a recent review of critical ecosystems in Pakistan, Roberts (1986) identifies the Indus riverine zone, and the Chaghai Desert and juniper forests of Baluchistan as being of unique ecological interest and international conservation importance.

Prior to 1966, Pakistan had taken no significant steps towards establishing a protected areas network. That year, at the invitation of the Government of Pakistan, the World Wildlife Fund carried out a survey of the country's wildlife resources and recommended measures to arrest their deterioration (Mountfort and Poore, 1967, 1968). These included the establishment of two large national parks and eight wildlife sanctuaries. This initiative was followed by the constitution of a Wildlife Enquiry Committee in 1968, which made further recommendations for the establishment of 4 national parks, 18 wildlife sanctuaries and 52 game reserves (GOP, 1971). These recommendations have been substantially exceeded: 4 national parks, 44 wildlife sanctuaries and 65 game reserves had been declared by 1978 (ALIC, 1981). During the period 1968-1971, various technical assistance was received from the Food and Agricultural Organi-

sation of the United Nations, which latterly included the appointment of an adviser to the Wildlife Enquiry Committee (Grimwood, 1969, 1972).

Protected areas have been created haphazardly, often in the absence of any criteria for their selection, and boundaries drawn with little or no ecological basis. Priorities to develop the existing network of protected areas are identified in the IUCN systems review of the Indomalayan Realm (MacKinnon and MacKinnon, 1986) and further recommendations are made in the Corbett Action Plan (IUCN, 1985). While most major habitats are represented within the existing protected areas system (MacKinnon and MacKinnon, 1986), a comprehensive systems review has never been carried out at the national level. Clearly, this is a priority in order to plan the further development of Pakistan's protected areas network.

Addresses

Conservator (Wildlife), National Council for Conservation of Wildlife, Ministry of Food, Agriculture and Cooperatives, 485 Street 84, G-6/4 ISLAMABAD (Cable AGRIDIV; Tlx 5844 MINFA PK; Tel. 829756)

Wildlife Warden, Wildlife Wing, Forest Department, Azad State of Jammu & Kashmir, MUZAFFARABAD (Tel. 18)

Divisional Forest Officer (Wildlife), Forestry & Wildlife Department, Government of Baluchistan, Spinny Road, QUETTA (Tel. 71298)

Director, Environment Directorate, Capital Development Authority, Sitara Market, ISLAMABAD (Tel. 826397)

Conservator of Forests, Northern Areas, PO Box 501, GILGIT (Tel. 360)

Conservator (Wildlife), Forest Department (Wildlife Wing), Government of NWFP, Shami Road, PESHAWAR (Tel. 73184)

Conservator of Forests (Parks & Wildlife), Wildlife Department, Government of Punjab, 2 Sanda Road, LAHORE (Tel. 61798/63947)

Conservator of Forests (Wildlife), Sind Wildlife Management Board, Aiwan-e-Saddar Road, PO Box 3722, KARACHI 1 (Tel. 523176)

Inspector-General of Forests, Ministry of Food, Agriculture and Cooperatives, Room 323, Block B, Pakistan Secretariat, ISLAMABAD (Cable AGRIDIV; Tlx 5844 MINFA PK; Tel. 825289)

IUCN (The World Conservation Union), Country Representative, 1 Bath Island Road, KARACHI 75530 (Tlx 24154 MARK PK; Tel. 573046/79/82)

Pakistan Wildlife Conservation Foundation, 485 Street 84, G-6/4 ISLAMABAD (Cable AGRIDIV; Tlx 5844 MINFA PK; Tel. 829756)

Pheasant Conservation Forum, Secretary, c/o National Council for Conservation of Wildlife, Ministry of Food, Agriculture and Cooperatives, 485 Street 84, G-6/4 ISLAMABAD (Cable AGRIDIV; Tlx 5844 MINFA PK; Tel. 829756)

World Pheasant Association (Pakistan), Chairman, 7 Aziz-Bhatti Road, The Mall, LAHORE

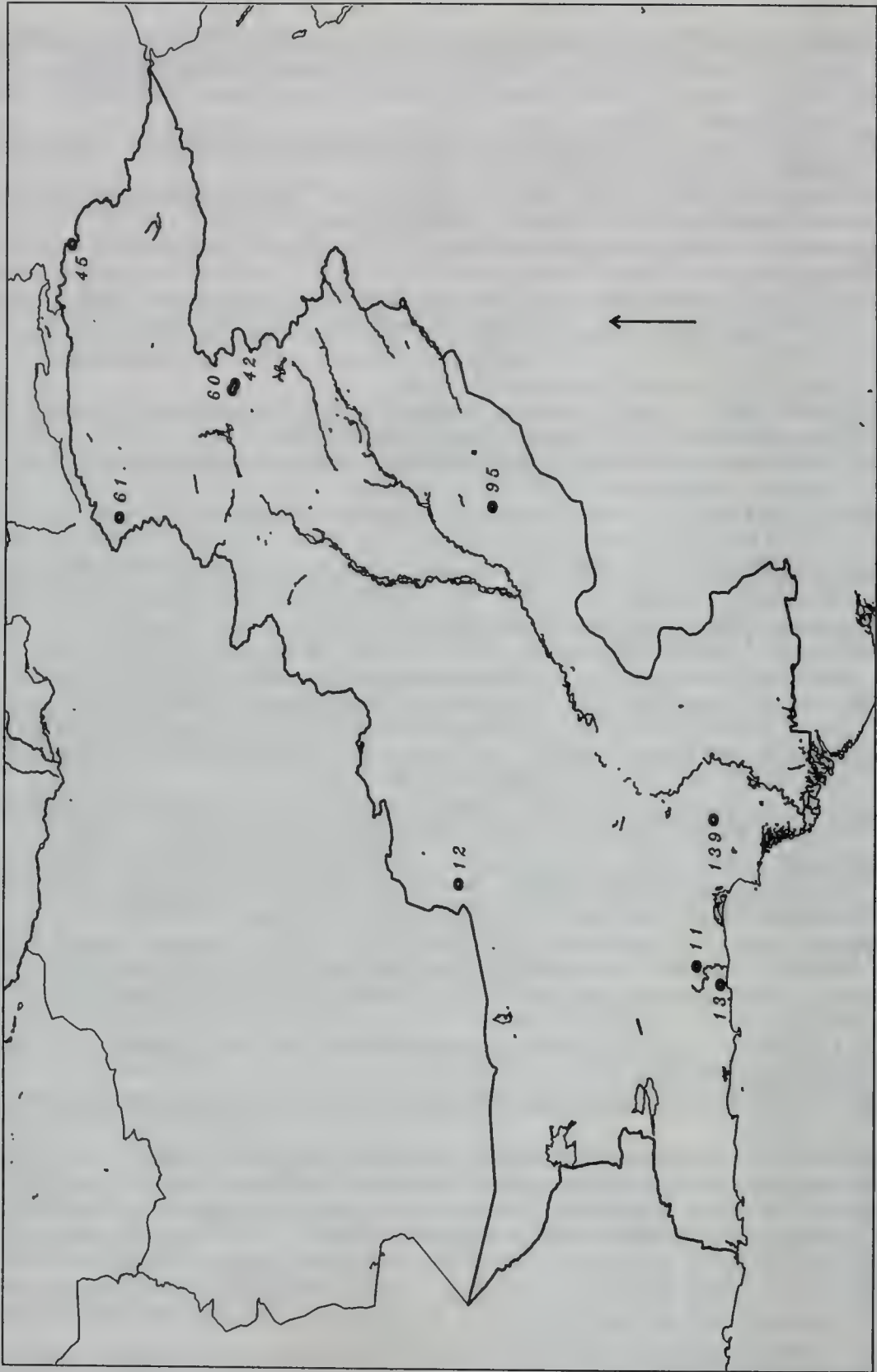
WWF-Pakistan, 1 Bath Island Road, KARACHI 75530 (Tlx 24154 MARK PK; Tel. 573046/79/82)

WWF-Pakistan, Director, P.O. Box 5180, LAHORE (Tlx 44866 PKGS PK; Fax 370429; Tel. 851174, 856177)

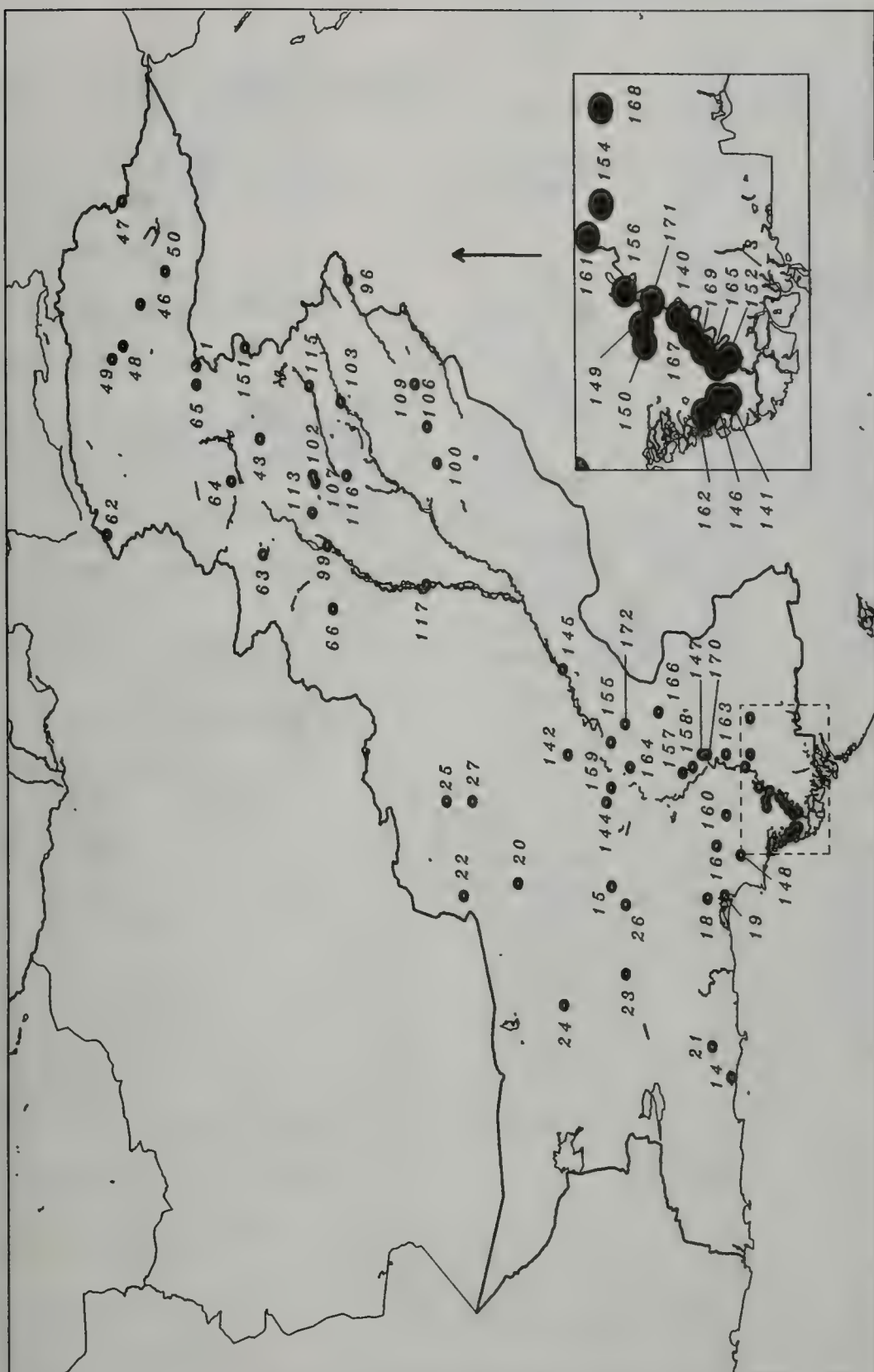
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National Parks of Pakistan
Numbers correspond to those in the summary.



Wildlife Sanctuaries of Pakistan
Numbers correspond to those in the summary.



Game Reserves of Pakistan

Numbers correspond to those in the summary.

Summary of Protected Areas of Pakistan

<i>National/International designation</i> Name of area and map reference ¹	IUCN Management category	Area (ha)	Year notified
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Biosphere Reserves

95 Lal Suhanra National Park*	IX	31,355	1977
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Ramsar Wetlands

144 Drigh Lake Wildlife Sanctuary*	IV	164	1976
150 Haleji Lake Wildlife Sanctuary*	IV	1,704	1976
Kandar Dam*	Unassigned	251	1976
107 Khabbeke Lake Wildlife Sanctuary*	IV	283	1976
Kheshki Reservoir*	Unassigned	263	1976
156 Kinjhar(Kalri) Lake Wildlife Sanctuary*	IV	13,468	1976
Malugul Dhand*	Unassigned	405	1976
Tanda Dam*	Unassigned	405	1976
90 Thanadarwala Game Reserve*	Unassigned	4,047	1976

AZAD JAMMU & KASHMIR

Wildlife Sanctuaries

1 Salkhala	IV	810	1982
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Game Reserves

2 Ghamot	Unassigned	27,283	1982
3 Hillan	Unassigned	423	1982
4 Machiara*	Unassigned	13,537	1982
5 Moji	Unassigned	3,861	1982
6 Mori Said Ali	Unassigned	243	1982
7 Phala/Kuthnar	Unassigned	324	1982
8 Qazi Nag	Unassigned	4,832	1982
9 Vatala	Unassigned	450	1982

Unclassified

10 Neelum Valley National Park	Proposed		
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Subtotal		50,953	
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BALUCHISTAN

National Parks

11 Dhrun	II	167,700	1988
12 Hazar Ganji-Chiltan*	V	15,555	1980
13 Hingol	II	165,004	1988

Subtotal		348,259	
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Wildlife Sanctuaries

14	Buzi Makola	IV	145,101	1972
15	Chorani	IV	19,433	1972
16	Dureji	IV	178,259	1972
17	Gut	IV	165,992	1983
18	Kachau	IV	21,660	1972
19	Khurkhera	IV	18,345	1972
20	Koh-e-Geish	IV	24,356	1969
21	Kolwah Kap	IV	33,198	1972
22	Maslakh	IV	46,559	1968
23	Raghai Rakhshan	IV	125,425	1971
24	Ras Koh	IV	99,498	1962
25	Sasnamana	IV	6,607	1971
26	Shashan	IV	29,555	1972
27	Ziarat Juniper*	IV	37,247	1971

Subtotal			951,235	
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Game Reserves

28	Bund Khush Dil Khan*	Unassigned	1,296	1983
29	Gogi	Unassigned	7,773	1962
30	Kambran	Unassigned	211,433	1983
31	Wam	Unassigned	10,364	1962
32	Zangi Nawar*	Unassigned	1,060	1982
33	Zawarkhan	Unassigned	3,887	1963

Subtotal			235,813	
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Unclassified

34	Astola Island (Haft Talar)	Recommended		
35	Chagai-Seistan Desert	Recommended		
36	Goth Raisani Game Reserve	Private		
37	Jiwani Beaches	Recommended		
38	Ormara Beaches	Recommended		
39	Nasirabad area	Private		
40	Pasni Coastline	Recommended		
41	Serajabad Game Reserve	Private		

FEDERAL CAPITAL TERRITORY

National Parks

42	Margalla Hills*	V	17,386	1980
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Wildlife Sanctuaries

43	Islamabad	IV	7,000	1980
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Games Reserves

44	Islamabad	Unassigned	69,800	1980
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NORTHERN AREAS

National Parks

45 Khunjerab*	II	226,913	1975
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Wildlife Sanctuaries

46 Astore*	IV	41,472	1975
47 Baltistan *	IV	41,457	1975
48 Kargah*	IV	44,308	1975
49 Naltar*	IV	27,206	1975
50 Satpara*	IV	31,093	1975

Subtotal		185,536	
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Game Reserves

51 Askor Nallah*	Unassigned	12,955	1975
52 Chassi/Baushdar*	Unassigned	37,053	1975
53 Danyor Nallah*	Unassigned	44,308	1975
54 Kilik/Mintaka*	Unassigned	65,036	1975
55 Nar/Ghoro Nallah*	Unassigned	7,255	1975
56 Nazbar Nallah*	Unassigned	33,425	1975
57 Pakora*	Unassigned	7,515	1975
58 Sher Qillah*	Unassigned	16,842	1975
59 Tangir*	Unassigned	14,251	1975

Subtotal		238,640	
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NORTH-WEST FRONTIER PROVINCE

National Parks

60 Ayubia	V	1,684	1984
61 Chitral Gol*	II	7,750	1984

Subtotal		9,434	
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Wildlife Sanctuaries

62 Agram Basti	IV	29,866	1983
63 Borraaka	IV	2,025	1976
64 Manglot	IV	715	1976
65 Manshi*	IV	2,321	1977
66 Sheikh Buddin	IV	15,540	1977

Subtotal		50,467	
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Game Reserves

67 Bagra	Unassigned	2,560	1987
68 Bilyamin	Unassigned	4,047	1974
69 Darmalak	Unassigned	9,788	1987
70 Drosh Gol	Unassigned	2,061	1979
71 Gehrait Gol	Unassigned	4,800	1979

72	Ghorazandi	Unassigned	6,649	1987
73	Goleen Gol	Unassigned	49,750	1982
74	Indus River	Unassigned	81,000	1987
75	Jabbar	Unassigned	13,288	1987
76	Kacha Marai	Unassigned	5,300	1984
77	Makhnial	Unassigned	4,148	1977
78	Maraiwam	Unassigned	5,300	1984
79	Nizampur	Unassigned	780	1976
80	Purit Gol/Chitral Chinar Gol	Unassigned	6,446	1979
81	Qalandar Abad	Unassigned	8,490	1980
82	Rakh Sardaran	Unassigned	4,200	1986
83	Rakh Topi	Unassigned	17,600	1984
84	Resi	Unassigned	5,050	1976
85	Shewaki-Chukhtoo	Unassigned	11,379	1987
86	Shina-Wari Chapri	Unassigned	1,000	1974
87	Sudham	Unassigned	11,500	1984
88	Swegali	Unassigned	1,820	1984
89	Teri/Isak Khumari	Unassigned	19,966	1987
90	Thanadarwala*	Unassigned	4,047	1976
91	Tooshi	Unassigned	1,545	1979
92	Totalai	Unassigned	17,000	1984
93	Zarkani	Unassigned	12,800	1984

Subtotal **312,314**

PUNJAB

National Parks

94	Chinji	II	6,095	1987
95	Lal Suhanra*	V	37,426	1972

Subtotal **43,521**

Wildlife Sanctuaries

96	Bajwat	IV	5,464	1964
97	Bhakkar Plantation	Unassigned	2,124	1986
98	Changa Manga Plantation	Unassigned	5,064	1986
99	Chashma Lake*	IV	33,084	1974
100	Chichawatni Plantation	Unassigned	4,666	1986
101	Cholistan	IV	660,949	1981
102	Chumbi Surla	IV	55,945	1978
103	Daphar	IV	2,286	1978
104	Depalpur Plantation	Unassigned	2,928	1986
105	Fateh Major Plantation	Unassigned	1,255	1986
106	Kamalia Plantation	Unassigned	4,397	1971
107	Khabbeke Lake*	Unassigned	283	1967
108	Khanewal Plantation	Unassigned	7,213	1986
109	Kharar Lake *	IV	235	1971
110	Kundian Plantation	Unassigned	7,800	1986

111	Machu Plantation	Unassigned	4,109	1986
112	Mitha Tiwana Plantation	Unassigned	1,116	1986
113	Nemal Lake*	IV	486	1970
114	Rajan Shah Plantation	Unassigned	2,110	1986
115	Rasool Barrage*	IV	1,138	1974
116	Sodhi	IV	5,820	1983
117	Taunsa Barrage*	IV	6,567	1972
118	Tehra Plantation	Unassigned	339	1978

Subtotal**815,378***Game Reserves*

119	Abbasia	Unassigned	10,067	1979
120	Bahawalpur Plantation	Unassigned	514	1978
121	Bheni	Unassigned	2,068	1955
122	Bhon Fazil	Unassigned	1,063	1978
123	Chaupalia	Unassigned	9,857	1960
124	Cholistan	Unassigned	2,032,667	1974
125	Daulana	Unassigned	2,429	1979
126	Diljabba-Domeli	Unassigned	118,106	1972
127	Gat Wala	Unassigned	5,883	1978
128	Head Islam/Chak Kotora*	Unassigned	3,132	1978
129	Head Qadirabad	Unassigned	2,850	1978
130	Indo-Pak Border	Unassigned		1980
131	Kala Chitta*	Unassigned	132,611	1983
132	Kathar	Unassigned	1,141	1978
133	Khari Murat	Unassigned	5,618	1964
134	Kot Zabzai	Unassigned	10,118	1978
135	Pirawala Kikarwala	Unassigned	506	1978
136	Rahri Bungalow	Unassigned	5,464	1978
137	Thal	Unassigned	71,306	1978

Subtotal**2,415,400***Unclassified*

138	Kalabagh Game Reserve*	Private	1,550	1966
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SIND*National Parks*

139	Kirthar*	II	308,733	1974
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Wildlife Sanctuaries

140	Bijoro Chach	IV	121	1977
141	Cut Munarki Chach	IV	405	1977
142	Dhoung Block	IV	2,098	1977
143	Dograyon Lake	IV	648	1978
144	Drigh Lake*	IV	164	1972
145	Ghondak Dhorro	IV	31	1977
146	Gullel Kohri	IV	40	1977

147	Gulsher Dhand	IV	24	1977
148	Hab Dam*	IV	27,219	1972
149	Hadero Lake*	IV	1,321	1977
150	Haleji Lake*	IV	1,704	1977
151	Hilaya	IV	324	1977
152	Keti Bunder North*	IV	8,948	1977
153	Keti Bunder South*	IV	23,046	1977
154	Khadi	IV	81	1977
155	Khat Dhero	IV	11	1977
156	Kinjhar (Kalri) Lake*	IV	13,468	1977
157	Kot Dinghano	IV	30	1977
158	Lakht	IV	101	1977
159	Langh (Lungh) Lake*	Unassigned	19	1977
160	Mahal Kohistan	IV	70,577	1972
161	Majiran	IV	24	1977
162	Marho Kohri	IV	162	1977
163	Miani Dhand	IV	57	1977
164	Mohabat Dero	IV	16	1977
165	Munarki	IV	12	1977
166	Nara Desert	IV	223,590	1980
167	Norang	IV	243	1977
168	Runn of Kutch	IV	320,463	1980
169	Sadnani	IV	84	1977
170	Samno Dhand	IV	23	1977
171	Shah Lanko	IV	61	1977
172	Takkar	IV	43,513	1968

Subtotal **738,628**

Game Reserves

173	Deh Jangisar	Unassigned	314	1965
174	Deh Khalifa	Unassigned	429	1965
175	Deh Sahib Saman	Unassigned	349	1966
176	Dosu Forest	Unassigned	2,312	1973
177	Hala	Unassigned	954	1965
178	Indus River*	Unassigned	44,200	1974
179	Khipro	Unassigned	3,885	
180	Mando Dero	Unassigned	1,234	1972
181	Mirpur Sakro	Unassigned	777	1965
182	Nara	Unassigned	109,966	1962
183	Pai	Unassigned	1,969	1976
184	Surjan, Sumbak, Eri and Hothiano	Unassigned	40,632	1976
185	Tando Mitha Khan	Unassigned	5,343	

Subtotal **212,364**

Unclassified

186	Hawkes Bay/Sandspit Beaches*	Recommended
187	Khairpur Game Reserve	Private

188	Pir Mahfooz Game Reserve	Private
189	Pir Pagara Game Reserve	Private

TOTALS

National parks (% total land area)	954,246 (1.2%)
Wildlife sanctuaries (% total land area)	2,749,054 (3.4%)
Game reserves (% total land area)	3,535,284 (4.4%)
TOTAL PROTECTED AREA	7,238,584 (9.0%)

*Site is described in this directory.

¹Locations of most protected areas are shown in the accompanying maps.

Date August 1986, updated September 1990

ASKOR NALLAH GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Situated in Baltistan District, 105 and 137 km by road from the towns of Skardu and Gilgit, respectively. Approximately 35°10'N, 75°04'E

Date and History of Establishment Declared a game reserve in on 22 November 1975.

Area 12,955ha

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 1,424m to 4,242m.

Physical Features Occupies the entire Askor Nallah and contains rugged and precipitous slopes. The area is composed of meta-sedimentary, sedimentary and various types of igneous rocks. Schistose, quartzite and other quaternary lake deposits, alluvium and stream gravels are present (Rasul, 1985).

Climate Mean annual precipitation ranges from 76mm to 102mm, mostly in the form of snow. Winters are dry and severe, while summers are mild (Rasul, 1985).

Vegetation Includes species of juniper *Juniperus*, birch *Betula* and willow *Salix*. Ground flora comprises *Artimesia* and a variety of grasses (Rasul, 1985).

Fauna Large mammals include markhor *Capra falconeri* (V), ibex *C. ibex* and snow leopard *Panthera uncia* (E). Avifauna includes chukar partridge *Alectoris chukar*, snow partridge *Lerwa lerwa* and snowcock *Tetraogallus* sp. (Rasul, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities None

Conservation Value No information

Conservation Management Wildlife is afforded full protection. Local inhabitants enjoy concessions to collect fallen dead wood, cut grass and graze livestock (Rasul, 1985).

Management Constraints Poaching is a problem due to the shortage of manpower (Rasul, 1985).

Staff One game watcher (1985)

Budget Rs 10,000 p.a. (1985)

Local Addresses No information

References

Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Date September 1988

ASTORE WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in the catchment area of Astore Nallah, between Nanga Parbat (8,126m) to the west and the Plains of Deosai to the east, and about 11 km from the town of Bunji. Approximately 35°38'N, 74°40'E

Date and History of Establishment Declared a wildlife sanctuary on 22 November 1975.

Area 41,472ha. The sanctuary is contiguous to Baltistan Wildlife Sanctuary (41,457ha) to the north-west.

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 1,212m to 6,060m.

Physical Features Comprises rugged and precipitous terrain, mostly composed of meta-sedimentary rocks, schistose gneiss and quartzite intruded by some basic dykes. The area contains a sequence of sedimentary and meta-sedimentary and several types of igneous rocks. Late cretaceous sediments overlay the green stone complex, while quaternary deposits, lake deposits, stream gravel and alluvium cover the bed rock in valleys (Rasul, 1985).

Climate Mean annual precipitation is 254-381mm, most of which falls as snow from November to January. Rain falls during the months of March, April and May, whilst August, September and October are the driest months. July and August are the hottest months (Rasul, 1985).

Vegetation Trees and shrubs include *Fraxinus*, *Olea*, *Juniperus*, kail, *Picea*, *Julgoza*, *Lonicera* and *Rosa*. *Artemisia* is prominent among the herbs, along with a variety of grasses.

Fauna Large mammals include markhor *Capra falconeri* (V), ibex *C. ibex*, musk deer *Moschus chrysogaster* (V), snow leopard *Panthera uncia* (E), brown bear *Ursus arctos*, lynx *Felis lynx*, wolf *Canis lupus* (V) and fox *Vulpes vulpes*. Avifauna includes a variety of game birds, such as chukar *Alectoris chukar*, snow partridge *Lerwa lerwa*, snowcock *Tetraogallus* sp., monal pheasant *Lophophorus impejanus*, raptors and vultures (Rasul, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities None.

Conservation Value The site was originally proposed as part of a much larger national park on account of the spectacular scenery and large mammal populations (Mountfort and Poore, 1968).

Conservation Management There is no management plan. Local people enjoy concessions to extract timber and firewood, graze livestock and cut grass (Rasul, 1985).

Management Constraints Include shortage of manpower, poaching and encroachment (Rasul, 1985).

Staff One range forest officer, one game inspector and one game watcher (1985)

Budget Rs 66,000 p.a. (1985)

Local Addresses No information

References

- Mountfort, G. and Poore, D. (1968). Report on the Second World Wildlife Fund Expedition to Pakistan. WWF, Switzerland. Unpublished report. 25 pp.
- Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Date September 1988

BALTISTAN WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Baltistan District, 193km and 48km from the towns of Skardu and Gilgit, respectively. Approximately 35°36'N, 75°08'E

Date and History of Establishment Declared a wildlife sanctuary on 22 November 1975

Area 41,457ha. The sanctuary is contiguous with Astore Wildlife Sanctuary (41,472ha) to the south-east.

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 1,515 to 5,527m.

Physical Features The sanctuary lies in Rondu Valley where the terrain is rugged, with precipitous mountain slopes. Rocks are meta-sedimentary, schistose and quartzite and also include a sequence of sedimentary, meta-sedimentary and igneous types. Quaternary lake deposits, stream gravel and alluvium are present in valleys. The major source of water is glacial meltwater, springs and snow (Rasul, 1985).

Climate Conditions are dry temperate. Annual precipitation is 76-102mm, most of which falls as snow during the months of November, December and January. Winters are severe (Rasul, 1985).

Vegetation Trees and shrubs include kail, *Picea*, *Juniperus*, *Olea*, *Fraxinus*, *Lonicera* and *Artemisia* (Rasul, 1985).

Fauna Large mammals include markhor *Capra falconeri* (V), ibex *C. ibex*, musk deer *Moschus chrysogaster* (V), urial *Ovis vignei*, snow leopard *Panthera uncia* (E), brown bear *Ursus arctos*, wolf *Canis lupus* (V) and fox *Vulpes vulpes*. Avifauna includes a variety of game birds, such as chukar *Alectoris chukar*, snow partridge *Lerwa lerwa*, snowcock *Tetraogallus* sp., raptors and vultures (Rasul, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities None

Conservation Value The sanctuary supports populations of a variety of threatened animal species.

Conservation Management Wildlife is afforded full protection. No management plan exists for the area. People living within an 8km radius of the sanctuary enjoy concessions to extract timber and firewood, graze livestock and cut grass (Rasul, 1985).

Management Constraints Include shortage of manpower, poaching and encroachment.

Staff One range forest officer, one game inspector and one game watcher (1985)

Budget Rs 66,000 p.a. (1985)

Local Addresses No information

References

Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Date September 1988

BUND KHUSH DIL KHAN GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 2.20.08 (Anatolian-Iranian Desert)

Geographical Location Lies in an inland drainage basin in the hills, 50km north-north-west of Quetta, Pishin District. 30°36'N, 66°45'E

Date and History of Establishment The reservoir was declared a game reserve in 1983.

Area 1,296ha

Land Tenure State (Provincial Government of Baluchistan)

Altitude 1,460m

Physical Features Comprises a water storage reservoir, with fringing reed-beds and several small islands constructed about 50 years ago to provide water for irrigation purposes. The reservoir is fed by local rainfall and seasonal flood waters from the surrounding hills. Depth of water is 2m-3m, but in dry years much of the reservoir dries out and only small scattered pools remain.

Climate Conditions are arid sub-tropical, with hot summers, cool winters and a short rainy season in summer. Mean annual rainfall is approximately 200mm. Temperatures range from a minimum of -10°C to a maximum of 35°C.

Vegetation Comprises reed beds with *Phragmites karka* and *Typha angustata*. Surrounding areas are cultivated.

Fauna The wetland is a breeding area for spotbill duck *Anas poecilorhyncha* and purple gallinule *Porphyrio porphyrio*, a very important staging area for migrating black stork *Ciconia nigra*, crane *Grus grus*, ducks and shorebirds, and an important wintering area for ducks and coot *Fulica atra*. Shelduck *Tadorna tadorna* and marbled teal *Marmaronetta angustirostris* have nested, and over 10,000 ducks and coots have been recorded in winters when water levels have been high. Over 4,800 waterfowl were recorded in mid-January 1987, including 3,200 mallard *Anas platyrhynchos* and nearly 1,000 common pochard *Aythya ferina*. Further details of the waterfowl are given in Scott (1989).

Cultural Heritage No information

Local Human Population The reservoir provides water for irrigation and human consumption, and outdoor recreation. Surrounding areas are cultivated and grazed by livestock.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Annual mid-winter waterfowl counts have been carried out in recent years.

Conservation Value The wetland is an important wintering, staging and breeding area for a variety of waterfowl.

Conservation Management No management plan exists. It has been proposed that the reserve be upgraded to a wildlife sanctuary.

Management Constraints The reservoir is silting up and the extent of wetland habitat is decreasing. There is a considerable amount of illegal waterfowl hunting as well as disturbance from settlements around the reservoir.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

CHASHMA LAKE WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Lies on the Indus River 25 km south-west of Mianwali. 32°25'N, 71°22'E

Date and History of Establishment Declared a wildlife sanctuary in 1974 and re-notified in July 1984.

Area 33,084ha

Land Tenure State (Provincial Government of the Punjab). Adjacent areas are partly state-owned and partly privately owned.

Altitude 225m

Physical Features Chashma is a large reservoir which was completed in 1971. It comprises bunds (embankments) which, at low water levels, divide the reservoir into five shallow lakes, each of up to 250ha in area. Maximum flooding occurs in spring; as the water recedes, exposed land is leased to local farmers for agricultural purposes. The depth of the five lakes varies from 0.2m in the dry season to 8.0m at the height of the flood season; the depth of the main river channel varies from 4.6m to 8.8m. The pH value ranges from 6.5 to 7.2.

Climate Conditions are dry sub-tropical, with hot summers and cool winters. Annual rainfall varies from 300mm to 500mm. Mean maximum temperature in June is 41°C and mean minimum in January is 4.5°C.

Vegetation The aquatic vegetation consists of *Hydrilla verticillata*, *Nelumbium speciosum*, *Nymphaea lotus*, *Typha angustata*, *Phragmites karka*, *Potamogeton pectinatus*, *Saccharum spontaneum*, *Vallisneria spiralis* and *Zannichellia palustris*. The natural vegetation of the region is a mixture of subtropical semi-evergreen scrub and tropical thorn forest, with species such as *Olea ferruginea*, *Acacia modesta*, *A. nilotica*, *Adhatoda vasica*, *Dodonea viscosa*, *Gymnospora royleana*, *Prosopis cineraria*, *Reptonia buxifolia*, *Salvadora oleoides*, *Tamarix aphylla*, *T. dioica*, *Zizyphus mauritiana*, *Z. nummularia*, *Chrysopogon aucheri*, *Lasiurus hirsutus*, *Heteropogon contortus* and *Panicum antidotale*. *Prosopis glandulosa* has been introduced to the area. Most of the natural thorn forest on the plains to the east of the Indus has been cleared for agricultural land and for irrigated plantations of *Dalbergia sissoo* and other species.

Fauna The wetland regularly supports over 50,000 Anatidae and coots in mid-winter, and in some years many more. Over 114,000 birds were present in January 1975, and about 100,000 in January 1987 and January 1988. The most abundant species are wigeon *Anas penelope*, teal *A. crecca*, pintail *A. acuta*, pochard *Aythya ferina* and coot *Fulica atra*. There is a small wintering flock of greylag goose *Anser anser*, and bar-headed goose *A. indicus* occasionally occurs on passage and in winter (recent maxima of 277 in 1982 and 65 in 1985). Peak counts have included: 1,800 great egret *Egretta alba*, 13,000 wigeon, 1,250 gadwall *A. strepera*, 16,300 teal, 3,900 mallard *A. platyrhynchos*, 10,100 pintail *A. acuta*, 2,300 shoveler *A. clypeata*, 25,000 pochard *Aythya ferina*, 3,100 tufted duck *A. fuligula* and 61,500 coot *Fulica atra*. Other regular winter visitors include great crested grebe *Podiceps cristatus*, black-necked grebe *P. nigricollis*, cormorant *Phalacrocorax carbo* and many species of shorebirds, gulls and terns. The wetland is also an important staging area in spring and autumn for cranes *Grus grus* and *Anthropoides virgo*. Further details of the waterfowl are given by Scott (1989).

Indus dolphin *Platanista indi* (E) occurs in some stretches of the Indus upstream of the barrage and has been recorded at Chashma, but no estimate of its population size is available. Other mammals present in the area include wild boar *Sus scrofa*, hog deer *Axis porcinus*, jackal *Canis aureus* and smooth-coated otter *Lutra perspicillata*.

The fish fauna is rich and includes *Gadusa chapra*, *Notopterus notopterus*, *N. chitala*, *Catla catla*, *Cirrhinus mrigala*, *C. rebo*, *Abeo rohita*, *L. microphthalmus*, *Puntius ticto*, *P. stigma*, *Barilius vagra*, *Wallago attu*, *Rita rita*, *Bagarius bagarius*, *Mystus aor*, *M. seenghala*, *Heterop-*

neustes fossilis, *Eutropiichthys vacha*, *Nandus nandus*, *Mastacembelus armatus*, *M. pancalus*, *Ambassis nama*, *A. ranga* and *Channa punctatus*. Other aquatic fauna includes *Hirudinaria* sp., *Palaemon dayanus*, *P. lamarrei*, *Rana tigrina*, *Kachuga smithi*, *Trionyx gangeticus* and *Lissemys punctata*.

Cultural Heritage No information

Local Human Population The local people fish in the lake and harvest reeds (*Phragmites karka*, *Typha angustata* and *Saccharum* spp.) for use in cottage industries.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Annual mid-winter waterfowl counts have been carried out since 1971. The status of the Indus dolphin is currently being assessed by the Punjab Wildlife Department and Zoological Survey Department.

Conservation Value The wetland is a very important staging and wintering area for a wide variety of waterfowl. It is also of socio-economic importance for flood control, storage of water for irrigation, generation of electricity and fisheries production (some 636 metric tonnes of fish were harvested in 1984). The marsh vegetation supports a local weaving industry and the barrage also provides excellent opportunities for scientific research and conservation education.

Conservation Management No information

Management Constraints There were plans to construct a large storage dam upstream of Chasma at Kalabagh, but these have been shelved. The construction of this dam would have affected the water regime at Chashma Barrage and limited its use for water storage. Fishing activities at the wetland and livestock grazing cause a considerable amount of disturbance. The marked fluctuations in water level and harvesting of reeds have an adverse impact on the aquatic vegetation.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

CHASSI/BAUSHDAR GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Gilgit District, 160km by road from the town of Gilgit. Approximately 36°11'N, 72°55'E

Date and History of Establishment Declared a game sanctuary on 22 November 1975

Area 37,053ha. Contiguous to Nazbar Nallah Game Reserve (33,177ha).

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 2,878m to 5,151m.

Physical Features The terrain is generally flat, with barren cliffs and scree slopes. Sedimentary and meta-sedimentary rocks and a sequence of quartzite, schistose and limestone are present. Baushter Nallah is perennial.

Climate Conditions are dry temperate. Annual precipitation ranges from 127mm to 254mm, most of which falls as snow. Winters are severe and long, while summers are short and mild.

Vegetation Trees and shrubs include stunted *Juniperus*, *Fraxinus*, *Betula*, *Salix* and *Rosa*. Herbs include *Artemisia*, *Stipa* and other grasses.

Fauna Large mammals include ibex *Capra ibex*, snow leopard *Panthera uncia* (E), brown bear *Ursus arctos* and fox *Vulpes vulpes*. Of the avifauna, there are a variety of game birds, such as chukar *Alectoris chukar*, snow partridge *Lerwa lerwa* and snowcock *Tetraogallus* sp. (Rasul, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities None

Conservation Value No information

Conservation Management Wildlife is afforded full protection and the reserve is completely closed to hunting and shooting. No management plan exists at present. Local inhabitants enjoy concessions to extract firewood, graze livestock and cut grass (Rasul, 1985).

Management Constraints Include shortage of manpower and poaching.

Staff One game watcher (1985)

Budget Rs 10,000 p.a. (1985)

Local Addresses No information

References

Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan.* Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Date September 1988

CHITRAL GOL NATIONAL PARK

IUCN Management Category II (National Park)

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Chitral, the northernmost district of North-West Frontier Province, about 3km west of Chitral Town. Approximately 35°50N, 71°47'E

Date and History of Establishment Declared a national park in 1984. Originally established as a private hunting reserve in 1880 by the Mehtars, the ruling family of the former State of Chitral. Subsequently declared a wildlife sanctuary on 23 December 1971 (Akbar, 1974).

Area 7,750ha

Land Tenure The entire Chitral Gol became state property in 1975, except for 8ha of cultivated land and several houses which still belong to the ex-Mehtar (Malik, 1985).

Altitude Ranges from about 1,500m at Hyrankot to 4,979m above Dunduni Gol; 24 peaks exceed 3,000m.

Physical Features Chitral Gol is a narrow valley, its gorge running for some 18km before broadening out into a basin surrounded by high peaks. Numerous tributaries drain into the Chitral Gol, which flows southwards into the Kunar River. Parent rock comprises shale and limestone from which are derived fairly fertile soils of up to a metre in depth on gentle slopes. The soil is porous and fragile, easily eroded by rainwater.

Climate Conditions are dry temperate and not influenced by the monsoon. Climatic data are available from Chitral Town (1,436m) where mean annual rainfall is 462mm, with a range of between 218mm (1905) and 675mm (1931). Mean annual temperature is 16.8°C, ranging from a maximum of 43.3°C to a minimum of 12.2°C. Most of the park is under snow from December until March (Akbar, 1974; Malik, 1985).

Vegetation The dry temperate oak *Quercus ilex* forest of lower altitudes merges into temperate coniferous forest above 2,400m, with the addition of *Cedrus deodara* and *Pinus gerardiana*. At higher altitudes, pine is replaced by *Juniperus macropoda* scrub. Above the tree-line at 3,350m occur *Salix* spp., *Viburnum cotoifolium* and *Juniperus communis*, along with numerous herbs (Akbar, 1974; Aleem, 1977a).

Fauna Chitral is famous for its markhor *Capra falconeri* (V). Schaller and Mirza (1971) estimated 100-125 in 1970, and Aleem (1976) 225 in 1975. A more recent estimate indicates a population size of 650 (Malik, 1985). Other ungulates, such as ibex *Capra ibex* and urial *Ovis vignei*, occur in very small numbers, as do black bear *Selenarctos thibetanus* (Aleem, 1977a; Malik, 1985). The status of snow leopard *Panthera uncia* (E) changed from tenuous security in 1970 to seriously threatened by 1974 (Schaller, 1976). The species does not appear to be resident, visiting the park occasionally (Malik, 1985). Wolves *Canis lupus* (V) are seen less frequently following restrictions on grazing by livestock (Malik, 1985).

Game birds include Himalayan snowcock *Tetraogallus himalayensis*, a small remnant population of Himalayan monal pheasant *Lophophorus impejanus*, snow partridge *Lerwa lerwa* and rock partridge *Alectoris graeca* (Akbar, 1974; Khan, 1976; Malik, 1985).

Cultural Heritage No information

Local Human Population None - the five families remaining in the park with their 40 cattle and 500 goats were evicted in December 1984. Seven villages with 300 families occur on the periphery of the park but their associated 100-150 cattle and 3,000-4,000 sheep and goats are no longer allowed to seasonally graze inside the park (Malik, 1985).

Visitors and Visitor Facilities Include two hunting lodges, originally built by the Mehtars.

Scientific Research and Facilities Large mammal populations were surveyed in the 1970s (Schaller and Mirza, 1971; Aleem, 1976; Schaller, 1976). The impact of grazing by domestic livestock on the vegetation, soil and wildlife has been examined (Aleem, 1977a). There are no research facilities.

Conservation Value The park is representative of an ecosystem that is unique in Pakistan.

Conservation Management Originally declared a wildlife sanctuary in order to protect the markhor. Objectives are to: preserve the landscape in its natural state, along with indigenous flora and fauna; manage wildlife populations, particularly the markhor, to maximise their production; and to develop facilities for research and tourism. Top priority has been given to controlling poaching and the government has decided to acquire all private lands and houses within the park. Concessions for firewood have been withdrawn in the case of inhabitants of villages peripheral to the park. Persons affected by these measures are receiving financial and other compensation to help offset losses, and former residents are being given preference for employment opportunities in the park. A special project to develop the park is planned to last until June 1988 at a cost of 4.8 million rupees. Apart from improving facilities (roads, footpaths and visitor accommodation), game reserves will be established in areas adjacent to the park to act as buffer zones (Malik, 1985).

Management Constraints Former management problems associated with land tenure, live-stock grazing, firewood collection and poaching have largely been alleviated (Malik, 1985). There is some concern about the markhor population which is presently managed for trophy hunting. In the 1985/86 winter, four permits (at US\$ 10,000 each) were issued to Shikar Safari Club International by the Conservator of Wildlife (T.J. Roberts, pers. comm.).

Staff Deputy ranger, head wildlife watcher and 12 wildlife watchers (1985)

Budget No information

Local Addresses Divisional Forest Officer (Wildlife), Chitral Gol National Park, Chitral, North-West Frontier Province

References

- Akbar, A. (1974). Chitral Gol Sanctuary for markhor. *Pakistan Journal of Forestry* 24: 209-212.
- Aleem, A. (1976). Markhor in Chitral Gol. *Pakistan Journal of Forestry* 26: 117-128.
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- Aleem, A. (1977b). Population dynamics of markhor in Chitral Gol. *Pakistan Journal of Forestry* 27: 86-92.
- Beg, A.R. and Ilahi Bux (1974). Vegetation of scree slopes in Chitral Gol. *Pakistan Journal of Forestry* 24(4). (Unseen)
- Khan, Y.M. (1976). A comprehensive report on wildlife resources (wildlife population census) of Chitral. Forest Department, Peshawar. Unpublished report. 11 pp.
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- Schaller, G.B. and Mirza, Z.B. (1971). Observations on urial and markhor in West Pakistan. New York Zoological Society, New York. Unpublished report. 4 pp.
- WWF/IUCN Project 562. Chitral Gol Reserve, Pakistan.

Date July 1986, updated August 1990

DANYOR NALLAH GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Gilgit District, 6km from the town of Gilgit. It is accessible only by bridle path. Approximately 35°55'N, 74°07'E

Date and History of Establishment Declared a game reserve on 22 November 1975.

Area 44,308ha

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 1,454m to 7,575m.

Physical Features The topography is undulating and rugged. In some places there are steep, precipitous slopes, becoming gentler at their upper limits. There are sedimentary, meta-sedimentary and igneous rocks with schist, quartzite and limestone. Alluvial deposits and stream gravels are also present in valleys (Rasul, 1985).

Climate Conditions are dry temperate. Mean annual precipitation is 76-102mm, most of which falls as snow during the months of November, December and January.

Vegetation Trees and shrubs include kail, *Picea*, *Salix*, *Juniperus*, *Olea*, *Pistacia*, *Hippophae*, *Fraxinus*, *Rosa* and *Betula*. Ground flora comprises *Artemisia*, *Haloxylon*, *Stipa* and other grasses (Rasul, 1985).

Fauna Large mammals include markhor *Capra falconeri* (V), ibex *C. ibex*, urial *Ovis vignei*, snow leopard *Panthera uncia* (E), and fox *Vulpes vulpes*. Avifauna includes a variety of game birds, such as chukar *Alectoris chukar*, snow partridge *Lerwa lerwa*, snowcock *Tetraogallus* sp. and vultures (Rasul, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities None

Conservation Value No information

Conservation Management Wildlife is afforded full protection and hunting is banned. No management plan exists for the area. Local people have concessions to collect firewood and timber and to also graze livestock.

Management Constraints Include shortage of manpower and poaching.

Staff One game watcher (1985)

Budget Rs 10,000 p.a. (1985)

Local Addresses No information

References

Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Date September 1988

DRIGH LAKE WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Situated in Sind Province about 32km north-west of Larkana. The eastern boundary of the sanctuary is defined by an earthen bund constructed to help retain the water, and the northern boundary by the Larkana-Qanber road. Approximately 68°05'E, 27°34'N

Date and History of Establishment Declared a wildlife sanctuary in October 1972 under Section 14 of the Sind Wildlife Protection Ordinance, 1972. Designated a Wetland of International Importance at the time of Pakistan's ratification of the Ramsar Convention on 23 July 1976.

Area 164ha of lake, surrounded by a buffer zone of 5km radius. (NB The area is given as 182ha in the management plan.)

Land Tenure State (Provincial Government of Sind). Public rights of access are limited to the public thoroughfare, which passes through the northern end of the lake, and a dirt road which runs just outside the western boundary of the sanctuary.

Altitude 50m

Physical Features Drigh is a small, slightly brackish lake with extensive marshes on the flood plain of the Indus River. Formerly an ancient arm of the Indus, it now lies about 30km from the river. The lake is situated in a region of cultivated plains, generally divided into small fields for rice cultivation. The limestone and sandstone hills of the Kalat Range lie some 80km to the west. In 1977, the clay and silt soils of the region were heavily impregnated with salts following heavy flooding. The lake is fed by monsoon rains, several small streams entering along the western side, and by water from a small canal to the north. There is no outlet channel. During the dry pre-monsoon period in early summer, some parts of the lake dry out. The lake has decreased in size in recent years as a result of the diversion of flood water for irrigation purposes, and is now almost completely overgrown with emergent vegetation.

Climate Conditions are arid subtropical. Mean rainfall for the region is 178mm, most of which falls during the monsoon season. Summers are hot with maximum temperatures up to 49°C in the shade. Winters are cold with a mean minimum of 2.2°C in January. Prevailing winds are north-east in winter and west-south-west in May-September (Sorley, 1968).

Vegetation Comprises dense growths of aquatic vegetation including *Cyperus alternifolius*, *Hydrilla verticillata*, *Najas minor*, *Scirpus littoralis*, *Ipomoea aquatica*, *Juncus articulatus*, *J. maritimus*, *Nymphaea lotus*, *Potamogeton pectinatus*, *Typha angustata* and *Tamarix dioica*.

Much of the wetland has become overgrown with *Typha* and *Tamarix* in recent years. High ground within the sanctuary is covered with *Saccharum* sp.

Fauna Drigh is a breeding area for a variety of resident waterfowl, a very important roosting site for night heron *Nycticorax nycticorax*, and formerly a very important wintering area for ducks and common coot *Fulica atra*. Over 32,000 ducks and coots were present in January 1973, but numbers then declined rapidly as the area of open water diminished. Less than 7,000 ducks and coots were present in 1975 and 1976, and only 820 were recorded in January 1987. However, large numbers of ducks were again present in the winter of 1987/88. Over 17,400 waterfowl were recorded in mid-January 1988, including: 6,500 common teal *Anas crecca*, 2,750 common pochard *Aythya ferina*, and 3,560 tufted duck *A. fuligula*. Very large numbers of night heron have roosted in the marshes for many years. About 1,500 were present in January 1987, and over 2,750 in January 1988. Details of other waterfowl known to occur in the sanctuary are given by Scott, 1989. The sanctuary is rich in birds of prey such as osprey *Pandion haliaetus*, Eurasian marsh harrier *Circus aeruginosus*, greater spotted eagle *Aquila clanga*, tawny eagle *A. rapax* and imperial eagle *A. heliaca*. Little is known about the other fauna of the sanctuary.

Cultural Heritage No information

Local Human Population Rice cultivation is the principal activity in surrounding areas.

Visitors and Visitor Facilities There is a rest house just outside the western boundary.

Scientific Research and Facilities Regular mid-winter counts of the waterfowl have been carried out by the Sind Wildlife Management Board since the early 1970s. There are no scientific facilities.

Conservation Value Drigh is an important breeding area for waterfowl but, with the partial drying out of the lake, its value as a wintering area for ducks has diminished (Roberts, 1984).

Conservation Management Cultivation of land, destruction of vegetation, hunting, shooting and trapping are prohibited. A management plan was prepared in 1977, in accordance with which objectives are: to provide optimum conditions for the large numbers of resident and migratory birds, particularly waterfowl; to provide for a limited amount of shooting on special occasions; and to provide facilities for scientists and the public to study and enjoy the wildlife (Conder, 1977). Recommendations for improved management include the construction of an embankment around the sanctuary with sluices to facilitate the control of water levels, and provision of observation towers and other facilities for visitors.

Management Constraints The diversion of water for irrigation purposes has resulted in lower water levels in the sanctuary. The area of open water has decreased in recent years, and much of the wetland is now overgrown with dense stands of *Typha* and *Tamarix*. Grazing pressure is reported to be heavy inside the sanctuary.

Staff No information

Budget No information

Local Addresses Divisional Forest Officer, Larkana, Sind Province

References Unless otherwise indicated, information is taken directly from Scott (1989).

- Conder, P.J. (1977).** Lake Drigh Wildlife Sanctuary (Management Plan). IUCN/WWF Project No. 1360. 11pp.
- Roberts, T.J. (1984).** Brief review of the status of wetlands in Pakistan. 10th Asian Continental Section Conference, ICBP, Cambridge. Unpublished report. 6pp.
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- Sorley, H.T. (1968).** *The former Province of Sind (including Khairpur State)*. Gazetteer of West Pakistan. Publication of the Government of West Pakistan. 809 pp. (Unseen)

Date August 1986, updated August 1990

HAB DAM WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 04.15.07 (Thar Desert)

Geographical Location Lies on the Hab River, 40km north of Karachi, on the border between Baluchistan and Sind provinces. 25°15'N, 67°07'E

Date and History of Establishment Declared a wildlife sanctuary in 1972.

Area 27,219ha. It is contiguous with Kirthar National Park (308,733ha).

Land Tenure State (Provincial Government of Sind). Adjacent areas are privately or communally owned.

Altitude 150m

Physical Features Hab Dam is a large water storage reservoir constructed in 1981. The Hab River rises in the Kirthar Range of eastern Baluchistan, and enters the Arabian Sea just west of Karachi. The water level in the reservoir fluctuates widely according to rainfall in the water catchment area; the maximum depth is 46m and the average drawdown 19m.

Climate Conditions are arid sub-tropical, with very hot summers, mild winters, and a mean annual rainfall of less than 200mm.

Vegetation There is reported to be an extensive growth of aquatic vegetation, but no details are available. The natural vegetation of the surrounding areas is open forest dominated by *Olea ferruginea* and *Acacia senegal* in association with *Tamarix aphylla*, *Prosopis cineraria*, *Acacia jacquemontii*, *Zizyphus nummularia*, *Euphorbia caudicifolia*, *Cymbopogon jwarancusa*, *C. schoenanthus*, *Lasiurus hirsutus* and *Eleusine compressa*.

Fauna Some 48,500 waterfowl were present in January 1987, and over 53,500 in January 1988. Maximum counts included up to 2,870 little grebe *Tachybaptus ruficollis*, 2,200 white pelican *Pelecanus onocrotalus*, 2,400 wigeon *Anas penelope*, 1,570 mallard *A. platyrhynchos*, 2,150

pintail *A. acuta*, 1,200 shoveler *A. clypeata*, 9,300 pochard *Aythya ferina*, 5,800 tufted duck *A. fuligula* and 32,000 coot *Fulica atra*.

The dam holds about 100 mugger *Crocodylus palustris* (V), and there are tentative plans to commercially ranch crocodiles (M. Woodford, pers. comm., 1990). The reservoir has been stocked with a variety of exotic fishes such as *Labeo rohita*, *Cyprinus carpio* and *Tilapia mossambica*.

Cultural Heritage No information

Local Human Population Hab Dam is used for fishing and has the highest fishery potential of the smaller reservoirs in Pakistan.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Some mid-winter waterfowl counts have been carried out in recent years.

Conservation Value Hab Dam is an important staging and wintering area for grebes, pelicans, ducks, cranes and coots. It also supplies drinking water to Karachi City and water for irrigating agricultural land in Lasbella District, Baluchistan.

Conservation Management There are plans to intensify the management of the sanctuary and to develop the area as a resort for outdoor recreation. Reafforestation is required in the water catchment area to reduce erosion and sustain stream flow throughout the year.

Management Constraints Fishing activities cause some disturbance to waterfowl. The dam has had a detrimental effect on the ecology of the estuarine system downstream.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

HADERO LAKE WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Situated in Sind Province about 85km east of Karachi, Hadero is accessible via the Makli Hills-Thatta-Jungshahi metalled road. It is within 6km of Haleji Lake Wildlife Sanctuary and about 16km to the south-west of Kinjhar Lake Wildlife Sanctuary. 67°52'E, 24°49'N

Date and History of Establishment Declared a wildlife sanctuary in March 1977 under Section 14 of the Sind Province Wildlife Protection Ordinance, 1972. First protected as a game sanctuary on 2 October 1971 under Section 15 of the West Pakistan Wildlife Protection Ordinance, 1959.

Area 1,321ha

Land Tenure The lake and stony desert to the north and west are state-owned (Provincial Government of Sind).

Altitude 60m

Physical Features The lake, probably no deeper than 1.5m, is a natural body of water set in a shallow depression on the edge of the stony desert. The bedrock is composed primarily of alternating layers of limestone and sandstone; the long peninsulas which jut out into the lake are capped by layers of limestone, while the lower lying areas of desert have exposed outcrops of sandstone. The northern and western shores are rocky and sandy, and border on stony desert; the southern and eastern shores are gently shelving, with saline mud and silt in an area of abandoned cultivation. The lake is fed by the SLM drain, which links up with the Jam Branch Canal, and by a few small streams on the north shore. There is no outlet.

Climate Conditions are dry subtropical monsoonal with hot summers and cool winters. Mean annual rainfall for the region is about 185mm, most of which falls in the monsoon season. Temperatures range from a maximum of 47°C in the shade in summer to a mean monthly minimum of 2.2°C in winter. Prevailing winds are north-east in December-January and west-south-west in May-September (Sorley, 1968).

Vegetation There is relatively little aquatic vegetation, apart from extensive beds of *Potamogeton pectinatus* and, at the southern end of the lake near the mouth of the SML drain, fringing beds of *Juncus maritimus* and stands of *Tamarix dioica*. Natural vegetation in the surrounding area includes tropical thorn forest dominated by *Acacia nilotica* on the plains and *Olea -A. senegal* forest on the hills.

Fauna The lake regularly held between 10,000 and 20,000 waterfowl in mid-winter during the early 1970s, since when numbers have increased. In January 1987, almost 49,000 birds were present, and in January 1988, the number of birds exceeded 55,000. Maximum counts include: 1,370 great cormorant *Phalacrocorax carbo*, 15,000 Eurasian wigeon *Anas penelope*, 1,900 common teal *A. crecca*, 4,000 northern pintail *A. acuta*, 1,700 northern shoveler *A. clypeata*, 4,900 tufted duck *Aythya fuligula*, 6,200 common pochard *A. ferina* and 24,000 common coot *Fulica atra*. Further details of the waterfowl are given by Scott (1989). Birds of prey are common, particularly osprey *Pandion haliaetus*. The stony deserts around the lake support wintering populations of Houbara bustard *Chlamydotis undulata* and cream-coloured courser *Cursorius cursor*. Further details of the avifauna are given by Scott (1989).

The lake is reported to be well stocked with fish (Conder, 1977). *Tilapia* has been introduced and attracts good numbers of cormorants and pelicans (T.J. Roberts, pers. comm., 1986).

Cultural Heritage No information

Local Human Population Kalri Village lies adjacent to the south-west corner of the lake.

Visitors and Visitor Facilities None

Scientific Research and Facilities Mid-winter waterfowl counts have been carried out regularly since 1971.

Conservation Value The lake is an important wintering area for a variety of waterfowl, notably pelicans, flamingos, ducks and coots. It also provides excellent opportunities for research.

Conservation Management Hunting, shooting and any other forms of disturbance to the wildlife is prohibited but commercial and sport fishing are permitted. A management plan was prepared in 1977, according to which the principal objective is to protect natural habitat in and around the lake in order to provide optimum conditions for the wide variety of resident and migratory birds, particularly waterfowl. Recommendations include the establishment of a no-fishing and no-boating zone in the north-east corner of the lake, banning of quarrying activities close to the sanctuary, and inclusion of some stony desert within the sanctuary. The stony desert to the north and west has a fauna and flora of special interest, and is covered by a Protection Ordinance.

Management Constraints Fishing and boating activities cause considerable disturbance to the waterfowl, and there have been reports of illegal hunting. In particular, the activities of Mohanas (fisherman tribe) living beside the lake are a constant source of disturbance to waterfowl (T.J. Roberts, pers. comm., 1986). There has been some excavation of roadstone materials within the sanctuary, and the landscape of surrounding hills has been marred by indiscriminate quarrying of limestone and dumping of unusable stone.

Staff The appointment of a sanctuary warden, two to three deputy sanctuary wardens, and seven assistant wardens to cover both Haleji and Hadero wildlife sanctuaries and replace the existing game watchers has been recommended (Conder, 1977).

Budget No information

Local Addresses No information

References Unless otherwise indicated, information is taken directly from Scott (1989).

Conder, P.J. (1977). Lake Hadero Wildlife Sanctuary (Management Plan). IUCN/WWF Project No. 1360. 7pp.

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Sorley, H.T. (1968). *The former Province of Sind (including Khairpur State)*. Gazetteer of West Pakistan. Publication of the Government of West Pakistan. 809 pp. (Unseen)

Date August 1986, updated August 1990

HALEJI LAKE WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Lies in Sind Province some 75km east of Karachi and 16km from the town of Thatta. Access is via a 5km long track leading off the main Karachi-Thatta highway at the 47th mile post. 67°47'E, 24°48'N

Date and History of Establishment Declared a wildlife sanctuary in March 1977 under Section 14 of the Sind Wildlife Protection Ordinance, 1972. Together with Chateji Dhand, first protected as a game sanctuary on 2 October 1971 under Section 15/1 of the West Pakistan Wildlife Protection Ordinance 1959 (Notification No: 26(2)20 AA & FT(FT)/71). Designated a Wetland of International Importance at the time of Pakistan's ratification of the Ramsar Convention on 23 July 1976.

Area 1,704ha of lake, surrounded by a buffer zone of 5km radius which was extended from 1.6km in 1975 (Notification No. WL & FT(DCF-GEN/75). Chateji Dhand lies within the boundaries of the sanctuary.

Land Tenure State (Provincial Government of Sind)

Altitude 60m

Physical Features Haleji is a perennial freshwater lake, with associated marshes and adjacent brackish seepage lagoons, set in a stony desert of limestone and sandstone bedrock. Originally a saline lagoon formed by seasonal rainwater collecting in a shallow depression, the lagoon was converted into a reservoir in the late 1930s to provide an additional water supply for Karachi. The salt water was drained, bunds (embankments) constructed around the lake, and the Jam Branch Canal carrying water from Kinjhar Lake diverted to it. This canal remains the principal source of water. The lake is drained by a link canal in the south-west corner. Maximum depth is 5-6m and the water level fluctuates by 1.0-1.5m. Salinity is 0.1-0.2 p.p.t. and pH ranges from 6.5 to 8.0. The bunds surrounding the lake carry a road lined with trees. Beyond are three

brackish seepage lagoons, originally the borrowpits from which the earth was removed to construct the bunds. The lagoons are fed by the monsoon rains, water discharged from the main lake via the by-pass regulator, and possibly seepage through the bunds. To the west of the lake, the land rises by about 12m and is capped with limestone. To the north, the land is more fertile but elsewhere water-logging and saline soils preclude agriculture. A short distance to the north-east in the vicinity of Kalri Village lies Chateji Dhand, a smaller lake about 3.2km long, 1.6km wide and up to 1.8m deep. This normally only floods after exceptionally heavy monsoons but can be filled from Haleji Lake via the by-pass regulator.

Climate Conditions are dry subtropical monsoonal. Mean annual rainfall for the region is 178mm, most of which falls during the monsoon season. Summers are hot with maximum temperatures of up to 49°C in the shade. Winters are cold with a January mean minimum of 2.2°C. Prevailing winds are north-east in December-January and west-south-west in May-September (Sorley, 1968).

Vegetation The lake supports abundant aquatic vegetation including extensive beds of *Phragmites karka*, *Typha angustata*, *Ipomoea aquatica*, *Cyperus* sp., *Scirpus littoralis* and *Polygonum barbatum*, and patches of *Nymphaea lotus* and *Eichhornia crassipes*. Submerged aquatic vegetation includes *Potamogeton pectinatus*, *P. perfoliatus*, *P. lucens*, *Vallisneria spiralis*, *Hydrilla verticillata*, *Najas minor*, *Lemna minor*, *Ceratophyllum demersum* and *Myriophyllum spicatum*. *Juncus maritimus* grows around the brackish seepage lagoons. Ornamental trees such as *Acacia nilotica*, *Ficus* sp. and *Casuarina* sp. have been planted on the bunds around the lake. The natural vegetation of surrounding areas includes *Acacia senegal*, *Tamarix dioica*, *Commiphora mukul*, *Prosopis cineraria*, *Euphorbia caudicifolia*, *Eleusine compressa*, *Pennisetum* sp., *Salvadora oleoides* and species of *Cymbopogon*, *Calotropis*, *Alhagi*, *Zizyphus*, *Salix*, *Sagittaria* and *Salsola*.

Fauna Mammals known to be present include mongooses *Herpestes* spp., jackal *Canis aureus*, wild boar *Sus scrofa* and black-naped hare *Lepus nigricollis*.

A wide variety of migrant waterfowl, particularly ducks and common coot *Fulica atra*, use Haleji Lake and the surrounding seepage lagoons. The sanctuary is also a breeding area for herons and egrets, cotton pygmy goose *Nettapus coromandelianus* (up to 55), spotbill duck *Anas poecilorhyncha* (up to 60), purple swamphen *Porphyrio porphyrio* (up to 1,470), and pheasant-tailed jacana *Hydrophasianus chirurgus* (up to 850). Many thousands of night heron *Nycticorax nycticorax* roost in the marshes. During the 1970s, the sanctuary regularly held between 60,000 and 100,000 ducks and coots in mid-winter. Over 53,000 waterfowl were present in early January 1987, and over 103,000 in late January 1988. Maximum counts of wintering birds have included: 1,160 little grebe *Tachybaptus ruficollis*, 2,020 great cormorant *Phalacrocorax carbo*, 12,800 Eurasian wigeon *Anas penelope*, 6,000 common teal *A. crecca*, 1,300 spotbill duck, 2,700 gadwall *A. strepera*, 1,230 mallard *A. platyrhynchos*, 6,800 northern pintail *A. acuta*, 7,900 northern shoveler *A. clypeata*, 9,300 common pochard *Aythya ferina*, 9,000 tufted duck *A. fuligula*, 76,600 common coot, and 2,000 whiskered tern *Chlidonias hybridus*. Further details of the waterfowl are given in Scott (1989).

The sanctuary is particularly rich in birds of prey, the commonest species being osprey *Pandion haliaetus* and marsh harrier *Circus aeruginosus*. At least 20 other species have been recorded including Brahminy kite *Haliastur indicus*, Pallas's fish eagle *Haliaeetus leucoryphus*, white-tailed eagle *H. albicilla*, pallid harrier *Circus macrourus*, greater spotted eagle *Aquila clanga*,

imperial eagle *A. heliaca*, tawny eagle *A. rapax*, red-necked falcon *Falco chicquera* and peregrine falcon *F. peregrinus*. Some 222 species of birds have been recorded by T.J. Roberts in the immediate vicinity of Haleji Lake and these are listed in Khan and Haleem (1986).

The lake supports a small population of the mugger *Crocodylus palustris* (V). Common cobra *Naja naja*, water snakes and common monitor *Varanus bengalensis* also occur.

The fish fauna includes *Notopterus notopterus*, *N. chitala*, *Gadusia chapra*, *Labeo gonius*, *L. rohita*, *L. fimbriata*, *Catla catla*, *Europhichthys vacha*, *Mystus gulio*, *M. tengara*, *M. aor*, *M. vittatus*, *Channa marulius*, *C. striatus*, *C. punctatus*, *Nandus nandus*, *Puntius (Barbus) sarana*, *P. ticto*, *P. stigma*, *Badis badis*, *Glossogobius* spp., *Crossocheilus latius*, *C. mrigala*, *Ambassis nama*, *A. ranga*, *Rasbora rasbora*, *R. daniconius*, *Xenentodon cancila* and *Mastacembelus armatus*. *Tilapia mossambica*, *Cyprinus carpio* and *Ctenopharyngodon idellus* have been introduced.

Cultural Heritage No information

Local Human Population There are four small villages and several nomadic settlements within the buffer zone (Conder, 1977).

Visitors and Visitor Facilities There are rest houses at Haleji Camp belonging to the Karachi Development Authority and a local tea house by the entry gate (Conder, 1977). An impressive information centre, with restaurant and observation tower, has been established by the Sind Wildlife Management Board and this was inaugurated in February 1982.

Scientific Research and Facilities Mid-winter waterfowl counts have been conducted regularly since 1971 by the Sind Wildlife Management Board and Zoological Survey Department, and a limnological survey carried out by Karachi University. A project to study the common monitor has been initiated by the Zoological Survey Department in collaboration with the US Fish and Wildlife Service.

Conservation Value Haleji and the surrounding seepage lagoons are an internationally important staging and wintering area for a variety of waterfowl. Situated only a short distance from Karachi, the sanctuary provides excellent opportunities for conservation education and scientific research.

Conservation Management The main purpose of the lake is to supply Karachi with freshwater for about 15 days in the year, usually in April when the canal from Kinjhar Lake, which normally supplies Karachi, is being cleaned out. The sanctuary is managed by the Sind Wildlife Management Board in agreement with the Karachi Development Authority, according to a management plan prepared by Conder (1977). Objectives outlined in the management plan are: to protect the habitat for the benefit of the large numbers of resident and migratory birds, particularly waterfowl; and to provide facilities for naturalists and interested members of the public to study and enjoy the wildlife. Shooting, cutting and lopping of trees, boating, commercial fishing and reed cutting for thatch are prohibited but angling is permitted under license to the Karachi Development Authority. The lake is dredged from time to time to remove silt from the channel along its eastern and southern sides. The extensive *Phragmites* beds have been cut annually since 1977, except near the tail regulator where there was a large roost of night herons. The roost has since been abandoned due to harassment by house crows *Corvus splendens*.

(T.J. Roberts, pers. comm., 1986). The Karachi Development Authority is proposing to build another reservoir alongside Haleji.

Management Constraints There have been some incidences of unauthorised access, illegal fishing, hunting and cutting of trees at Haleji Lake, and considerable disturbances from nomadic settlements and illegal hunting at Chateji Dhand which is easily accessible from the Jungshahi-Thatta road. Recently, university scientists reported to a local Karachi newspaper their concern about plastic bags littering the fringe of the lake, dead turtles and the uncontrolled growth of *Hydrilla* and *Typha* (Dawn, 18 July 1989).

Staff No recent information. It has been recommended that a sanctuary warden, two or three deputy sanctuary wardens and seven assistant sanctuary wardens replace existing game watchers to cover both Lake Halji and Lake Hadero (Conder, 1977).

Budget No information

Local Addresses No information

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Date August 1986, updated August 1990

HAWKES BAY/SANDSPIT BEACHES

IUCN Management Category Recommended

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Lies on the Arabian Sea coast and stretches from Manora Point, at the mouth of Karachi harbour, westwards as far as Buleji Point. 24°47'-24°52'N, 66°50'-66°59'E

Date and History of Establishment Recommended as a reserve for marine turtles.

Area 20km stretch of beach and c. 2,000ha of tidal creeks

Land Tenure State (Provincial Government of Sind)

Altitude Sea level

Physical Features Comprises a gently sloping sand beach, with open sandy approaches and some submerged rocks offshore. The eastern part of the beach (Sandspit) is entirely sand; the western part (Hawkes Bay) has some rocky areas. The beaches are backed by a narrow, low primary dune ridge, behind which is a complex of sandy plains and tidal marshes. The beach platform is high enough to remain above the high tide mark at all times of the year except during the monsoon when it can be inundated by high tides.

Climate Conditions are arid subtropical with temperatures remaining high throughout the year. Mean annual rainfall is 125mm, and mean annual temperature 32°C.

Vegetation Dunes are consolidated in patches by *Ipomoea pescaprae* and grasses; the sandy plains support *Acacia*; and the tidal marshes are dominated by mangrove *Avicennia marina*.

Fauna The beach is a very important nesting site for green sea turtle *Chelonia mydas* (E) and olive ridley *Lepidochelys olivacea* (E); Kabraji and Firdous (1984) estimated that some 6,000 green sea turtle and 200 olive ridley came to the beach to nest each year during the period 1981-1983. Thirty two-species of shorebirds have been recorded, including crab plover *Dromas ardeola*. The commonest species are snowy plover *Charadrius alexandrinus*, lesser sand plover *C. mongolus*, sanderling *Calidris alba*, little stint *C. minuta* and dunlin *C. alpina*. Over 52,000 waterfowl were recorded in mid-January 1975, including at least 5,000 snowy plover and sand plover, 1,650 pintail *Anas acuta*, 2,000 little stint, 20,000 dunlin, 10,000 unidentified small shorebirds and 7,880 black-headed gull *Larus ridibundus*. No comparable censuses have been carried out since 1975, but 2,100 and 1,700 waterfowl were recorded during partial surveys in January 1987 and January 1988, respectively.

Cultural Heritage Turtle meat and eggs are not considered religiously desirable to eat by the local Muslims, but eggs are sometimes used in indigenous medicines (Kabraji and Firdous, 1984).

Local Human Population Areas of urban development exist along the northern and eastern shores of the creek system.

Visitors and Visitor Facilities There are many holiday houses along the beach, which is used for recreation and fishing.

Scientific Research and Facilities Marine turtles have been surveyed by Salm (1981) and their conservation requirements assessed by Kabraji and Firdous (1984). The Zoological Survey Department is carrying out a research project on the shorebirds of the Karachi coast.

Conservation Value The site is of international importance for green sea turtle. The creek system is one of the most important areas for wintering, passage and summering shorebirds in Pakistan, and also supports significant numbers of cormorants, flamingos, ducks, gulls and terns. It has been recommended that the property be declared a turtle reserve (Salm, 1981).

Conservation Management A marine turtle conservation project, initiated by WWF and implemented by the Sind Wildlife Management Board, has been in operation since 1980. One of the main aims of the project has been to protect turtle eggs from depredation; this has been achieved by collecting eggs from the wild, hatching them in enclosures, and then releasing the hatchlings into the sea. The beaches are patrolled and feral dogs are controlled to reduce predation levels. The project also includes a conservation education component.

Management Constraints The beaches are a prime recreational site for the citizens of Karachi. Settlements are springing up along the beach, and the levels of disturbance and pollution are continually increasing. Principal threats to the marine turtles are disturbance from recreational activities and predation by humans and feral dogs. Turtles and their hatchlings frequently lose direction and orient themselves towards the bright lights of Karachi City to the north-east. The mangroves have been severely denuded as a result of grazing by camels and cutting for fodder, and there is a considerable amount of domestic and industrial pollution in the creek system.

Staff No information

Budget No information

Local Addresses Sind Wildlife Management Board, P O Box 3722, Stratchen Road, Karachi 1

References Unless otherwise indicated, information is taken directly from Scott (1989).

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Date August 1990

HAZAR GANJI-CHILTAN NATIONAL PARK

IUCN Management Category V (Protected Landscape)

Biogeographical Province 2.20.08 (Anatolian-Iranian Desert)

Geographical Location Lies in Baluchistan Province, some 20km south-west of the provincial capital of Quetta. The boundaries of the original area of 12,561ha are described in the management plan (Rana, 1981). 29°59'-30°07'N, 66°24'-66°54'E

Date and History of Establishment Notified a national park on 15 January 1980 (Notification No. SOA(IV) 133/79-Forest Vol.I). Hazar Ganji was originally declared a state forest in 1890 and Chiltan a protected forest in 1964. Hazar Ganji was subsequently notified a game reserve in 1959 and later declared a wildlife sanctuary (Rana, 1981; Rafiq, 1985).

Area 15,555ha. The original area of 12,561ha, comprising Hazar Ganji State Forest (2,201ha) and Chiltan Protected Forest (10,360ha) (Rana, 1981), was extended to 13,761ha in the early 1980s (Shafique, 1984) and subsequently to its present size. There are plans to increase the area to about 150,000ha (Rafiq, 1985).

Land Tenure State (Provincial Government of Baluchistan)

Altitude Ranges from 1,680m to 3,313m (Chiltan Peak).

Physical Features The area is mountainous with precipitous slopes divided by ravines. The Chiltan Hills and Hazar Ganji Range lie west and east, respectively, of the north-south Chiltan divide. Bedrock is sedimentary limestone and soils on the flats are sandy loam (Rafiq, 1985).

Climate Mean annual precipitation is 200-225mm, most of which falls in winter when snow remains on the higher peaks from December until the end of March. Temperatures rise to a maximum of 40°C in summer and fall to a minimum of -12°C in winter (Rafiq, 1985).

Vegetation Forest cover is sparse and generally confined to gullies (Rana, 1981). Scrub forest occurs at low altitudes, with an open canopy of *Pistacea khinjak*, *P. cabulica* and *Fraxinus xanthoxyloides*, and a second storey of *Sophora griffithi*, *Artemisia maritima*, *Prunus brahuica*, *Ephedra* sp., *Holoxylon griffithi* and *Perovskia striplicifolia* (Shafique, 1984). *Juniperus macropoda* occurs in the higher reaches of the park. The fencing along the southern border of the park has had a dramatic effect on the recovery of the vegetation, with many showy flowers in spring, such as *Gentiana livieri*, *Ixiolirion montanum*, *Ferrula oopoda* and *Salvia* spp. (T.J. Roberts, pers. comm., 1986). Some 225 plant species have been recorded by the Botany Department of the University of Baluchistan (Shafique, 1984).

Fauna The Chiltan Hills harbour the largest remaining population of Chiltan markhor *Capra falconeri chiltanensis* (V). In the 1950s it was said to exceed 1,200 (Rana, 1981), but in November 1970 the population was estimated to number about 200, based on a total count of 107 individuals (Schaller and Mirza, 1971). Subsequently, Mirza (1975) counted 168 animals. The population is presently estimated at about 300 (Valdez, 1988). The Suleiman markhor *C.f. jerdoni* (V) is also present in the northern part of the Chiltan Range and a few urial *Ovis orientalis* still survive on the western slopes between 1,500m and 2,100m (Shafique, 1984). Carnivores include hyaena *Hyaena hyaena* and fox *Vulpes vulpes*. Three species of sand rat are present: *Meriones persicus* above 1,830m, and lower down *M. libycus* and *M. crassus* occur in more exposed places (T.J. Roberts, pers. comm., 1986).

The scops owl *Otus scops* is present and sympatric with striated scops owl *O. brucei*. Other noteworthy birds include common cuckoo *Cuculus canorus*, European bee-eater *Merops apiastur*, rock partridge *Alectoris graeca*, European nightjar *Caprimulgus europaeus unwini*, long-billed pipit *Anthus similis*, orphean warbler *Sylvia hortensis*, variable wheatear *Oenanthe picata*, blue rock thrush *Monticola solitarius*, stonechat *Saxicola torquata*, and Lichtenstein's desert finch *Rhodospiza obsoleta* (T.J. Roberts, pers. comm., 1986).

Cultural Heritage Neighbouring areas are inhabited by Shahwani tribals.

Local Human Population No information

Visitors and Visitor Facilities The national park is accessible by road from Quetta and attracts many visitors. Facilities include a museum, picnic spots and accommodation in rest houses.

Scientific Research and Facilities Preliminary surveys of the flora have been undertaken by the Botany Department of the University of Baluchistan. The dynamics of rodent populations in Hazar Ganji have been studied by the Vertebrate Pest Research Institute, University of Karachi. The status of the Chiltan markhor population was assessed by Schaller and Mirza (1971) and subsequently by Mirza (1975). The Forest Department has agreed to establish a captive population of Chiltan markhor for taxonomic studies and to provide stock for possible re-introduction programmes (Valdez, 1988). A hut is available for visiting scientists.

Conservation Value The park is most important as a refuge for the largest remaining population of Chiltan markhor.

Conservation Management Although a state forest for many decades, the forests of Hazar Ganji were never exploited on a commercial scale. Nevertheless, the habitat became degraded and wildlife populations reduced due to over-exploitation. Park development began in 1978. Objectives outlined in the management plan include protecting the wildlife, improving and restoring its habitat and improving the amenity value of the area for the benefit of the residents of Quetta. Efforts to protect the park, including the erection of 30km of boundary fencing, have resulted in a marked recovery of the vegetation and an increase in the Chiltan markhor population. Other initiatives include planting of fodder trees and high-yielding nutritious grasses on the flats and the provision of waterholes and two reservoirs. Livestock grazing and wood cutting are prohibited but the Shahwanis are allowed to collect the fruit of shina *Pistacea khinjak* (Rana, 1981; Shafique, 1984; Rafiq, 1985). A system of zonation is proposed with recreation zones of varying intensities of use, a wilderness area and special areas of scientific importance. Adjoining areas within an 8km radius of the national park will serve as a buffer zone within which shooting will be prohibited (Rana, 1981).

Management Constraints The ecosystem, fragile on account of the aridity, was heavily over-exploited up until 1977 when controls were introduced. The vegetation is recovering as witnessed by the sharp contrast between the healthy vegetation within the park and the eroded landscape beyond (Shafique, 1984). The Forest Department's plans to extend the area of the park to about 150,000ha is likely to conflict with the interests of the local human population (Rafiq, 1985).

Staff No information

Budget Annual expenditure of Rs 1.2 lakhs increasing to 3.6 lakhs proposed for the period 1981/82-1985/86 (Rana, 1981).

Local Addresses No information

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Date August 1986, updated August 1990

HEAD ISLAM/CHAK KOTORA GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Lies 30km south-east of Vehari. 29°50'N, 72°34'E

Date and History of Establishment Declared a game reserve in 1978 and re-notified in 1983.

Area 3,132 ha

Land Tenure State (Provincial Government of the Punjab). The reservoir is under the authority of the provincial Irrigation Department; adjacent agricultural land is privately owned.

Altitude 139m

Physical Features Head Islam is a water storage reservoir on the Sutlej River, from which water is distributed by canal for irrigation purposes. Two embankments project out into the reservoir and hold back shallow lagoons as the water level in the main river channel recedes. The combination of shallow water areas, rich aquatic vegetation and wet agricultural land provides excellent habitat for waterfowl during the autumn migration season. The lagoons dry out completely towards the end of December, however, when the area becomes less suitable for wintering birds. The depth of water in the main channel varies from 3m to 6m, and that in the seepage lagoons from 0.1m to 3m.

Climate Conditions are dry sub-tropical, with an annual rainfall of 200-300mm. Minimum temperatures in January range from 5.5°C to 18°C, and maximum temperatures in June from 32°C to 46°C.

Vegetation Aquatic vegetation includes *Hydrilla verticillata*, *Juncus* sp., *Nelumbium speciosum*, *Phragmites karka*, *Potamogeton* spp., *Typha angustata*, *Zannichellia palustris*, *Desmostachya binata* and *Cynodon dactylon*. Land around the reservoir is mainly under cultivation for cotton, rice, wheat, sugar cane and fodder crops. The natural vegetation of the surrounding plains is tropical thorn forest with *Acacia nilotica*, *Prosopis cineraria*, *Tamarix aphylla*, *T. dioica*,

Salvadora oleoides, *Capparis aphylla*, *Zizyphus nummularia*, *Aristida mutabilis*, *Cynodon dactylon*, *Eleusine compressa* and *Pennisetum divisum*.

Fauna Some 1,150 waterfowl were recorded in early January 1987, with a high species diversity. Counts included 140 little grebe *Tachybaptus ruficollis*, 125 cormorant *Phalacrocorax niger*, 180 herons and egrets of 5 species, 110 spoonbill *Platalea leucorodia*, 190 common coot *Fulica atra*, 38 black-winged stilt *Himantopus himantopus* and small numbers of various species of ducks and shorebirds. Similar numbers of birds were present in January 1988.

Mammals include hog deer *Axis porcinus*, greatly reduced in number, jackal *Canis aureus*, jungle cat *Felis chaus*, wild boar *Sus scrofa* and black-naped hare *Lepus nigricollis*. Gharial *Gavialis gangeticus* (E) formerly occurred in the main river channel, but disappeared after the construction of a dam upstream.

Fishes include *Ambassis nama*, *A. ranga*, *Bagarius bagarius*, *Catla catla*, *Channa marulius*, *C. punctatus*, *Cirrhinus mrigala*, *C. reba*, *Heteropneustes fossilis*, *Labeo calbasu*, *L. microphthalmus*, *L. rohita*, *Mastacembelus armatus*, *Mystus aor*, *Nandus nandus*, *Notopterus chitala*, *N. notopterus*, *Puntius sophore*, *P. ticto*, *Rita rita* and *Wallago attu*.

Cultural Heritage No information

Local Human Population The reservoir is used for fishing and as a water supply for surrounding areas. Land exposed at low water levels is leased for the cultivation of cotton, rice, wheat and fodder crops.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Annual mid-winter waterfowl counts have been carried out in recent years.

Conservation Value The wetland is an important staging area for migratory waterfowl, particularly Anatidae and shorebirds, during the autumn migration season. Most birds depart when the seepage lagoons dry out in December. The reservoir is an important source of water for irrigation and supports a small commercial fishery. The site has some value for outdoor recreation, including bird-watching and boating.

Conservation Management It has been proposed that ownership of the area be transferred from the Irrigation Department to the Wildlife Department, and that the area be managed as a wildlife sanctuary in the interests of its hog deer, partridges *Francolinus* spp. and waterfowl. There is no management plan.

Management Constraints Agricultural activities around the seepage lagoons and fishing in the reservoir disturb the waterfowl, and there is some illegal hunting. The wide fluctuations in water level make the site less attractive for waterfowl during winter.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

INDUS RIVER GAME RESERVE

IUCN Management Category No category assigned

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Comprises a 170km stretch of the Indus River between Guddu and Sukkur barrages in Sind Province. 27°40'-28°26'N, 68°53'-69°46'E

Date and History of Establishment Declared a game reserve on 24 December 1974 (Government of Sind Notification No. WL & FT (DCF-GEN-767) 74).

Area 44,200ha

Land Tenure State (Provincial Government of Sind)

Altitude 50m

Physical Features The Indus and its main tributaries are perennial, the volume of water discharged varying in relation to seasonal meltwater and rainfall. The maximum volume (50%) of the annual discharge of the Indus is observed in the summer monsoon months of July-September and only 15% in the winter season from October to March, when its width varies from 50m to 1km, its current speed from 0.1 to 1.5m per sec and its depth is not less than 6m. As a result of the very gentle gradient of the Indus in the Punjab and Sind, and the enormous quantity of detritus borne downstream, the river bed is raised above the level of the surrounding plains. The river bed comprises mud and sand. Owing to the high amount of detritus, the water is extremely turbid and the visual range from the surface downwards is only about 5cm (Pilleri and Zbinden, 1973-1974).

Climate Water temperature in winter ranges from a minimum of 12°C at night to a daytime maximum of 24°C, while the air temperature varies from 2°C to 35°C (Pilleri and Zbinden, 1973-1974.)

Vegetation The following plants are associated with areas of inundation and marshland along the Indus: *Saccharum spontaneum*, *Phragmites communis*, *Tamarix dioica*, *Typha elephantina*, *T. angustata*, *Arundo donax*, *Paspalum ditichum* and *Erianthus* spp. The freshwater flora is limited to planktonic forms.

Fauna The Indus dolphin *Platanista indi* (E) is a blind cetacean endemic to the Indus River and found in greatest numbers between Guddu and Sukkur barrages. About 150 were censused in January 1974 (Pilleri and Zbinden, 1973-1974), 187 in April-May 1977 (Pilleri and Bhatti, 1978), 241 in May 1978 (Pilleri and Bhatti, 1978), 292 in June 1979 (Pilleri and Bhatti, 1980), 346 in April 1980 (Bhatti and Pilleri, 1982) and 429 in 1986 (Khan, 1986). There is some doubt as to the comparability of these census data due to differences in the reliability of survey techniques; nevertheless, it is believed that the population has actually increased following the strict protective measures afforded to the species since 1974 (Khan and Niazi, 1989). Other aquatic vertebrates include turtles (*Kachuga smithii*, *Trionyx gangeticus* and *Lissemys punctata*) and gharial *Gavialis gangeticus* (E), which locally is almost extinct. Aquatic birds include large colonies of Laridae and egrets. Common species of fish are mali *Wallago attu*, singari *Macrones aor* and marakho *Catla buechanani*, all of which are taken by the Indus dolphin (Pilleri and Zbinden, 1973-1974).

Cultural Heritage No information

Local Human Population Mohanas (Mohammedans of the Jubbah caste) used to catch dolphins, being mainly dependent for their livelihood on the sale of dolphin oil for medicinal purposes and on its meat for food.

Visitors and Visitor Facilities None

Scientific Research and Facilities The Indus dolphin population has regularly been censused since 1974. In 1977, a research project to identify the species conservation requirements was initiated by World Wildlife Fund, with support from the Volkart Foundation in Karachi, and subsequently financed by Sind Wildlife Management Board (Khan, 1981).

Conservation Value The reserve was established for the protection of the Indus dolphin.

Conservation Management Construction of a series of barrages across the Indus River, to supply energy and facilitate irrigation of the Sind Desert, had split the Indus dolphin population into completely isolated groups. Development of irrigation systems in the middle and upper reaches of the river had drastically lowered the water level further downstream, making conditions unsuitable for the species. With the added pressure of hunting, numbers had declined to a perilously low level. On 23 December 1974, all hunting of the Indus dolphin in the waters of Sind Province was prohibited (Notification No. WL & FT (DCF-GEN-762)74) and, on 24 December 1974, the waters of the Indus River between Guddu and Sukkur barrages were declared a game reserve. The species is now well protected within the reserve and no incidences of poaching have been reported in recent years (Pilleri and Bhatti, 1978; Bhatti and Pilleri, 1982). The status of the Indus dolphin further upstream in Punjab Province, however, is critical and it has been recommended that the adjacent stretch of the Indus from above Guddu Barrage to Taunsa Barrage be established as a reserve (Pilleri and Bhatti, 1980; Khan and Niazi, 1989).

Management Constraints At least 50 Indus dolphins are estimated to have been taken from between Sukkur and Guddu each year (Pilleri and Zbinden, 1973-1974) but poaching is now under control (Pilleri and Bhatti, 1978; Bhatti and Pilleri, 1982). There is no large-scale commercial fishing, although a great number of fish are caught in pools left after flooding. This and limited human recreational activity (e.g. bathing) do not seem to be detrimental to the dolphins. Several stretches of the river now dry up in winter and habitat is being reduced as

increasing amounts of water are withdrawn for irrigation purposes. Increasing pollution of the Indus from domestic sewage and industrial waste may represent a serious long-term threat (Ali, 1986).

Staff One divisional forest officer/research officer and four game watchers (1980)

Budget Rs 100,000 per year (1981)

Local Addresses No information

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Date July 1986, updated August 1990

KALA CHITTA GAME RESERVE

IUCN Management Category No category assigned

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Situated in the Kala Chitta Hills of Punjab Province, about 60km south-west of Islamabad and 20km south-east of Campbellpur. Approximately 33°38'N, 72°31'E

Date and History of Establishment Declared a game reserve in 1983, having previously been protected as a reserved forest.

Area 132,611ha

Land Tenure State (Provincial Government of Sind)

Altitude Ranges from 250m to 710m.

Physical Features Kala and Chitta are two distinct ranges. Parent rocks are limestone and sandstone. The soil is thin and shallow in limestone areas but adequate for tree growth. That in sandstone areas is devoid of humus and supports only xerophytes (Aleem, 1977).

Climate Conditions are subtropical continental. Base on meteorological data for a 40-year period from Campbellpur, mean annual precipitation is 584mm, with nearly 50% falling in July-September, monthly mean maximum temperature is highest (40.8°C) in June, and monthly mean minimum temperature is lowest (2.2°C) in January (Aleem, 1977).

Vegetation The Kala Chitta Hills are covered by dry subtropical broad-leaved forest. In limestone areas, *Olea cuspidata* is dominant on northern aspects and *Acacia modesta* on southern aspects (Champion, Seth and Khattak, 1965).

Fauna The area is important for Punjab urial *Ovis orientalis punjabiensis* and chinkara *Gazella gazella*. In January 1976, some 47 urial were counted and 20-25 chinkara estimated within an area of 50 sq.km. Carnivores include jackal *Canis aureus*, Bengal fox *Vulpes bengalensis*, yellow-throated marten *Martes flavigula* and leopard *Panthera pardus* (T). The black-naped hare *Lepus nigricollis* is also present (Aleem, 1977).

Birds of prey include lanner falcon *Falco biarmicus* and peregrine falcon *F. peregrinus*. Common game birds are chukar partridge *Alectoris chukar*, see-see partridge *Ammoperdix griseogularis* and grey francolin *Francolinus pondicerianus* (Aleem, 1977).

Cultural Heritage No information

Local Human Population The area is sparsely populated (Aleem, 1977) but it is grazed by some 3,000 sheep, goats, cattle and camels (Pakistan Forest Institute, 1977).

Visitors and Visitor Facilities No information

Scientific Research and Facilities The urial population was censused on January 1976 and the vegetation sampled for palatable species (Aleem, 1977; Pakistan Forest Institute, 1977). It was subsequently censused in the winter of 1985/1986 by a team from the University of Edinburgh.

Conservation Value The reserve supports small populations of Punjab urial and chinkara.

Conservation Management Shooting of urial is prohibited. Grazing conditions are good, with little sign of overgrazing. The available forage was considered adequate to support domestic livestock and wild ungulate populations in 1976 (Aleem, 1977).

Management Constraints The vegetation is subject to felling and cutting practices, and poaching is commonplace (Aleem, 1977). Recent reports indicate that the urial population has been decimated (T.J. Roberts, pers. comm., 1986).

Staff No information

Budget No information

Local Addresses No information

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Date July 1986, updated August 1990

KALABAGH GAME RESERVE

IUCN Management Category Unassigned (Private)

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Lies at the western extremity of the Salt Range some 30km south-east of Kalabagh Town. Approximately 32°50'N, 71°38'E

Date and History of Establishment Originally created a reserve in 1966 by the late Nawab of Kalabagh and recognised as such by the international conservation community (Mountfort and Poore, 1968). The reserve has not been notified a private game reserve under the Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1975.

Area Approximately 1,550ha

Land Tenure State (Provincial Government of the Punjab). The land is leased from the government by the Malik family.

Altitude Approximately 300-1,000m

Physical Features Hills rise gently from a flat plain, then enter a rugged area of small plateaux, whose edges drop vertically to boulder-strewn stream beds of sharply tilted strata of rock and limestone bluffs, and culminate in a series of ridges (Schaller and Mirza, 1974).

Climate Conditions are arid, with an annual rainfall of 500mm or less, most of which falls in July and August. Temperatures reach 40°C or more during the hot season (Schaller and Mirza, 1974).

Vegetation Comprises *Acacia* scrub woodland, dominated by *A. modesta* which grows scattered on the slopes and along stream beds often in association with *Salvadora oleioides*, *Zizyphus nummularia* and other trees. Shrubs are sparse, except in some ravines and high ridges where *Dodonaea viscosa* is prominent. Grasses include *Aristida depressa*, *Cenchrus pennisetiformis*, *Eleusine flagellifera* and *Cymbopogon jawarancusa* (Schaller and Mirza, 1974).

Fauna The reserve is noted for its large populations of Punjab urial *Ovis orientalis punjabiensis* and chinkara *Gazella gazella bennetti*. Populations of both species have been reduced or extirpated throughout much of their former range elsewhere in Pakistan. About 500 urial inhabited the reserve in 1970 (Schaller and Mirza, 1974), and 75-100 chinkara were recorded within an area of 7.5 sq. km in 1970-1974 (Schaller, 1976). Carnivores include jackal *Canis aureus* and fox *Vulpes vulpes*, but leopard *Panthera pardus* (T) was eliminated from the area prior to 1970 (Schaller and Mirza, 1974; Schaller, 1976). Blackbuck *Cervus cervicapra* has been introduced to the reserve as part of a national effort to re-establish the species in Pakistan (Anon., 1987).

Cultural Heritage No information

Local Human Population The land is grazed by livestock belonging to the Malik family. Lower slopes and a few level terraces are partially cultivated but most of the area is too arid and rocky for anything except livestock grazing (Schaller and Mirza, 1974).

Visitors and Visitor Facilities There is a rest house belonging to the Malik family.

Scientific Research and Facilities Schaller and Mirza (1974) conducted a one-month behavioural study of the Punjab urial in 1970, and Schaller (1976) also made some preliminary observations of chinkara over a three-month period in 1970-1974.

Conservation Value Kalabagh's scenery is imposing. The reserve represents the last remaining refuge of the Punjab urial in the Salt Range and holds the largest known population.

Conservation Management The reserve was created specifically to protect the Punjab urial (Mountfort and Poore, 1968), but wildlife inhabiting the property of the late Nawab of Kalabagh had been protected for at least the previous 30 years (Schaller and Mirza, 1974). Livestock belonging to the Malik family are raised in the reserve but managed in the interests of wild ungulate populations.

Management Constraints Poaching is a persistent problem, particularly in the more isolated mountainous areas, and sometimes involves the armed forces. Even when offenders are brought to trial, little or no action is taken by the relevant authorities (M.A. Khan, pers. comm., 1986).

The world's largest dam was due to be constructed on the Indus just above Kalabagh township. With access to the construction site planned *via* the reserve, it was anticipated that the wildlife would be heavily poached (M.A. Khan, pers. comm., 1986). The project proved to be very controversial and has since been shelved for the time being (Hussain, 1988; Mumtaz, 1989).

Staff Several game guards (1986)

Budget No information

Local Addresses Kalabagh Estate, District Mianwali, Punjab

References

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Date August 1990

KANDAR DAM

IUCN Management Category Unassigned

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Lies south-east of Kohat. 33°36'N, 71°29'E

Date and History of Establishment Designated a Wetland of International Importance at the time of Pakistan's ratification of the Ramsar Convention on 23 July 1976.

Area 251ha

Land Tenure State (Government of North-West Frontier Province)

Altitude 255m

Conservation Value Kandar is a small water storage reservoir of minor importance for waterfowl as a staging and wintering area. Only 90 waterfowl were recorded in January 1987,

and only two birds (greenshank *Tringa nebularia*) were seen in January 1988. It is no longer considered to be of sufficient importance to merit designation as a Ramsar site.

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

KARGAH WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in the Northern Areas, 5km from the town of Gilgit. Approximately 35°56'N, 74°06'E

Date and History of Establishment Declared a wildlife sanctuary on 22 November 1975.

Area 44,308ha

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 1,515m at the mouth of Kargah Nullah to 4,242m at Chilali.

Physical Features The sanctuary comprises the catchment area of the Kargah Nullah. The meta-sedimentary and sedimentary sequence includes slates, quartzites, limestone and gneiss of pre-Carboniferous age. There are granodiorite and horn-blended granite intrusions. Igneous rocks are post Permo-Carboniferous in age (Rasul, 1985).

Climate Annual precipitation in the valley is 152-203mm, most of which falls as snow during the severe winter months of December and January. June and July are the hottest months (Rasul, 1985).

Vegetation Trees and shrubs include *Fraxinus*, *Salix*, *Olea*, *Pistacia*, *Juniperus*, kail, *Picea*, *Betula*, *Rosa* and *Daphnes oleides*. Ground cover consists of *Artemisia*, *Stipa*, *Haloxylon* and other grass species.

Fauna Large mammals include markhor *Capra falconeri* (V), ibex *C. ibex*, musk deer *Moschus chrysogaster* (V) and snow leopard *Panthera uncia* (E). The avifauna includes chukar *Alectoris chukar*, snow partridge *Lerwa lerwa* and snowcock *Tetraogallus* sp. Monal pheasant *Lophophorus impejanus* is seen occasionally (Rasul, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities None

Conservation Value The sanctuary provides a refuge for a variety of threatened mammals.

Conservation Management No management plan exists. Wildlife is afforded full protection. People living near the forest and in the town of Gilgit enjoy concessions to extract firewood and graze livestock. Residents of Kargah benefit from timber for domestic use (Rasul, 1985).

Management Constraints Include shortage of manpower, poaching and agricultural encroachment.

Staff One game watcher (1985)

Budget Rs 10,000 p.a. (1985)

Local Addresses No information

References

Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Date September 1988

KETI BUNDAR NORTH AND KETI BUNDAR SOUTH WILDLIFE SANCTUARIES

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Situated in the Outer Indus Delta, south-east of Karachi. 23°45'-24°45'N, 67°10'-68°15'E

Date and History of Establishment Both Keti Bundar North and South were declared wildlife sanctuaries in 1977. They lie within Keti Bundar North Protected Forest (80,487ha) and Keti Bundar South Protected Forest (183,616ha), respectively.

Area	Keti Bundar North Wildlife Sanctuary:	8,948ha
	Keti Bundar South Wildlife Sanctuary:	23,046ha

Land Tenure State (Provincial Government of Sind)

Altitude Sea level

Physical Features The Outer Indus Delta is a vast complex of tidal river channels and creeks, low-lying sandy islands, mangrove swamps and intertidal mudflats stretching for over 150km from near Korangi Creek in the north-west to Sir Creek on the Indian border. In the south-east, the landward edge of the mangrove forest borders on the vast salt flats of the Great Rann of Kutch. The water levels and salinities in the delta fluctuate widely according to the flow of the Indus.

Climate Conditions are arid subtropical, with a mean annual rainfall of 204mm, a mean relative humidity of 76%, a mean air temperature of 28.8°C, a mean mud temperature of 28.1°C, and a mean surface water temperature of 27.8°C.

Vegetation The Outer Indus Delta supports extensive mangrove forests consisting almost entirely of *Avicennia marina* (99.9%). There are some localised patches of *Ceriops tagal*, particularly in the Shahbunder area in the south-east. *Aegiceras corniculatum* formerly occurred in the delta, but has now been almost exterminated from the Sind coast. *Salsola foetida* and marram grass *Ammophila* sp. grow on some of the sandy islands. The dominant seaweeds are species of *Ulva* and *Enteromorpha*.

Fauna The mangrove forest provides nesting sites for several species of herons and egrets, the intertidal mudflats support major concentrations of wintering shorebirds, and the brackish lagoons behind the mangroves sometimes hold large numbers of ducks and flamingos. Species recorded regularly in the area include Dalmatian pelican *Pelecanus crispus*, cormorant *Phalacrocorax carbo*, western reef heron *Egretta gularis*, little egret *E. garzetta*, great egret *E. alba*, grey heron *Ardea cinerea*, white spoonbill *Platalea leucorodia*, greater flamingo *Phoenicopterus ruber*, oystercatcher *Haematopus ostralegus*, avocet *Recurvirostra avosetta*, little ringed plover *Charadrius dubius*, Kentish plover *C. alexandrinus*, Mongolian plover *C. mongolus*, godwit *Limosa limosa*, bar-tailed godwit *L. lapponica*, whimbrel *Numenius phaeopus*, curlew *N. arquata*, redshank *Tringa totanus*, greenshank *T. nebularia*, sanderling *Calidris alba*, little stint *C. minuta*, dunlin *C. alpina*, curlew sandpiper *C. ferruginea*, Indian black-headed gull *Larus brunnicephalus*, black-headed gull *L. ridibundus*, herring gull *L. argentatus*, lesser black-backed gull *L. fuscus*, Caspian tern *Hydroprogne caspia*, gull-billed tern *Gelochelidon nilotica*, common tern *Sterna hirundo* and little tern *S. albigrons*.

Three species of cetaceans, plumbeous dolphin *Sousa plumbea*, finless porpoise *Noemeris phocaenoides* and bottle-nosed dolphin *Turciops aduncus*, have been recorded in the delta region. Jackal *Canis aureus* occurs on some of the islands and feeds on sand rat *Meriones hurrianae*. Saw-scaled viper *Echis carinatus* also survives on some of the islands. Seven species of sea-snakes have been reported, the commonest being *Enhydra schistosa*, *Hydrophis cyan-ninctus* and *Microphalophus graciosus*.

Mudskippers *Periophthalmus* sp. are abundant throughout the mangroves. Other species of fish recorded in the Shah Bundar area include *Nematalosa nasus*, *Anodontosoma chacuada*, *Thryssa hamiltonii*, *T. purava*, *T. malabarica*, *Mugil tade*, *M. subviridis*, *Liza vaigiensis*, *Polynemus plebeius*, *Pomadasys argyreus*, *Jhonijs belangerii*, *Pampus argenteus*, *Platycephalus scaber* and *Euryglossa orientalis*. Fishes known to occur elsewhere in the delta include *Culpea chapra*, *C. lile*, *C. fimbriata* and *Synaptura orientalis*.

Common invertebrates include crabs of the genus *Uca*; shrimps of the genera *Penaeus* and *Metapenaeus*; and squids of the genus *Sepia*. Ghost crabs *Ocypoda rotundata* and *Neptunus pelagicus* are abundant on the sandy islands.

Cultural Heritage No information

Local Human Population There are many small fishing villages and other settlements in the delta and extensive agricultural lands to the north. Mangroves are grazed by domestic livestock (cows, buffaloes and camels) and also cut for cattle fodder.

Visitors and Visitor Facilities No information

Scientific Research and Facilities A major programme of research is currently being developed with a view to the preparing a management plan for the Indus Delta. The Zoological Survey Department has recently initiated a detailed study of the mangrove forest and its vertebrate fauna in the Shahbunder area.

Conservation Value The delta contains by far the the most extensive tracts of mangrove forest in Pakistan, with large areas still in a relatively undisturbed condition. It is also an extremely important area for both resident and migratory waterfowl of a wide variety of species. The mangrove ecosystem is of considerable importance as a breeding and nursery ground for both shrimp and fin fish, which support a major fishery along the coast of Sind. Mangroves also provide protection against storms and tidal waves, and under proper management could be an extremely valuable fodder and timber resource.

Conservation Management A management plan for the mangrove forests has been prepared by the Sind Forest Department, but has yet to be implemented. A project for the management of the mangrove ecosystem of the Indus Delta has been drawn up in collaboration with IUCN/UNEP, and is currently being considered by the Government of Pakistan. The main objective of the project is to check and reverse the problems of over-exploitation and pollution.

Management Constraints Major threats to the Indus Delta are pollution, over-exploitation of the mangrove and fishery resources, and increasing salinity. The Indus River and its distributaries carry an immense load of urban, industrial and agricultural effluents into the coastal wetlands. Excessive grazing pressure and the large-scale cutting of mangroves for fodder have already denuded much of the mangrove vegetation in peripheral areas. Over-fishing, especially in the breeding season, is posing a serious threat to the sustainability of the resource over the long term. The freshwater flushing of the mangroves has been disrupted as a result of the construction of barrages on the Indus River and diversion of water for irrigation. The resultant increasing salinity may now be threatening the continued survival of the mangrove forest.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

KHABBEKE LAKE WILDLIFE SANCTUARY

IUCN Management Category Unassigned)

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Lies in the Salt Range, 10km north-east of Nowshera and 38km north-north-west of Khushab, Khushab District. 32°37'N, 72°14'E

Date and History of Establishment Declared a wildlife sanctuary in 1967 and re-notified on 17 November 1975. Designated a Wetland of International Importance at the time of Pakistan's ratification of the Ramsar Convention on 23 July 1976. However, the wildlife sanctuary is due to be denotified because of changes in its ecological character and the decline in numbers of wintering waterfowl.

Area 283ha

Land Tenure State (Provincial Government of the Punjab). Adjacent agricultural land is privately owned, and the forests and range lands in the watershed are communally owned.

Altitude 978m

Physical Features Khabbeke is a shallow brackish lake which is fed by local rainfall and several intermittent streams rising in the surrounding hills. The water level has risen by 30-60cm in recent years, increasing the lake's size and decreasing its salinity. Its maximum depth is now about 10.5m. A salinity of 5.2 p.p.t. was recorded in April 1987, and a pH of 7.2 in January 1987.

Climate Conditions are dry subtropical with hot summers and cool winters. Annual rainfall varies from 300mm to 800mm. Temperatures range from a mean minimum of 0.5°C in January to a mean maximum of 36°C in June.

Vegetation Aquatic vegetation includes *Carex fedia*, *Hydrilla verticillata*, *Juncus* sp., *Phragmites karka*, *Potamogeton crispus*, *Saccharum spontaneum*, *Typha angustata*, *Vallisneria spiralis* and *Zannichellia palustris*. The natural vegetation of the region is a mixture of subtropical semi-evergreen forest and tropical thorn forest, with species such as *Acacia modesta*, *Adhatoda vasica*, *Dodonea viscosa*, *Gymnosporia royleana*, *Olea ferruginea*, *Reptonia buxifolia*, *Tamarix aphylla*, *Withania coagulans*, *Zizyphus mauritiana* and *Z. nummularia*. Most of the natural vegetation around the lake has been cleared for agriculture.

Fauna As many as 8,700 waterfowl were recorded in the early 1970s, but numbers have fallen drastically in recent years. No white-headed duck *Oxyura leucocephala* (V) or greater flamingo *Phoenicopterus ruber* have been recorded for several years, and only 100 waterfowl were present in January 1986. During censuses in January 1987 and January 1988, respectively, 1,390 and 2,310 waterfowl were counted.

Mammals and amphibians known to occur in the area include jackal *Canis aureus*, fox *Vulpes vulpes*, Indian hare *Lepus nigricollis* and frog *Rana tigrina*. Introduced fishes include *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala*, *Cyprinus carpio* and *Ctenopharyngodon idella*.

Cultural Heritage No information

Local Human Population The lake now supports a commercial fishery. It is also used for domestic washing and illegal hunting. Principal activities in surrounding areas are agriculture and livestock grazing.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Mid-winter waterfowl censuses have been carried out annually since 1971.

Conservation Value The lake used to be a very important wintering area for white-headed duck, and a regular wintering area for greater flamingo and many other species of waterfowl.

Conservation Management No information

Management Constraints Changes in the salinity and water level have altered the ecology of the lake, and this has been compounded by large-scale stocking with herbivorous fish species. It is believed that direct competition between the introduced fishes and waterfowl for food has been responsible for the decline in waterfowl numbers in recent years. Fishing activities cause a considerable amount of disturbance to waterfowl, particularly in November when wintering birds first arrive at the lake. There is some illegal hunting. Pollution from domestic waste is also reported to be a problem.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

KHARAR LAKE WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Lies on the plains to the south of the Ravi River, 20km north-east of Okara, Okara District. 30°53'N, 73°35'E

Date and History of Establishment The lake was first designated as a wildlife sanctuary in 1971; the sanctuary was re-notified in June 1983.

Area 235ha

Land Tenure State (Provincial Government of the Punjab)

Altitude 180m

Physical Features Kharar is a shallow brackish/saline lake, with associated brackish marshes. It was created in 1945 as a result of water-logging, and is fed by local run-off and seepage from adjacent irrigated agricultural land. During the flood season, excess water from adjacent land is diverted to the lake, causing a reduction in salinity. The depth of water varies from 0.2m to 3.0m. A pH value of 8.0 was recorded in October 1986.

Climate Conditions are dry subtropical, with a mean annual rainfall of 225mm. Mean minimum temperature in January is 9.5°C, and mean maximum in June is 35°C.

Vegetation Aquatic vegetation includes *Carex fedia*, *Chara* sp., *Cynodon dactylon*, *Hydrilla verticillata*, *Juncus* sp., *Phragmites karka*, *Potamogeton* spp., *Saccharum* spp., *Typha angustata* and *Zannichellia palustris*. Surrounding areas are mainly under cultivation for cotton, rice, wheat, and sugar cane. The natural vegetation of the surrounding plains is tropical thorn forest with species such as *Tamarix aphylla*, *Prosopis cineraria*, *Zizyphus mauritiana*, *Z. nummularia*, *Acacia nilotica*, *Crotolaria burhia*, *Aerua javanica*, *Suaeda fruticosa*, *Salsola foetida*, *Eleusine compressa* and *Panicum antidotale*. *Pennisetum typhoides* and *Triticum aestivum* are widely cultivated.

Fauna Over 66,000 waterfowl were recorded in mid-January 1987, of which the most numerous species were wigeon *Anas penelope* (3,870), gadwall *A. strepera* (5,860), teal *A. crecca* (21,200), pintail *A. acuta* (8,730), shoveler *A. clypeata* (3,600), coot *Fulica atra* (12,600) and pochard *Aythya ferina* (10,300). A particularly noteworthy winter visitor is white-headed duck *Oxyura leucocephala* (V), with 48 recorded in 1987.

Mammals known to occur in the area include wild boar *Sus scrofa*, jackal *Canis aureus*, jungle cat *Felis chaus* and black-naped hare *Lepus nigricollis*.

Fishes include *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Ctenopharyngodon idella* and *Wallago attu*. Other aquatic fauna includes *Hirudinaria* sp., *Rana tigrina* and *Trionyx gangeticus*.

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities Annual mid-winter waterfowl counts have been carried out since 1971. The Punjab Fisheries Department has been conducting a study of the fishes and gathering data on salinity levels.

Conservation Value The lake is an important wintering area for waterfowl, particularly Anatidae, and a staging area for migratory shorebirds. It is one of three wetlands in Pakistan where the threatened white-headed duck winters in significant numbers. The wetland supports an important fishery, and provides excellent opportunities for scientific research, conservation education and nature-oriented recreation.

Conservation Management In 1984, the Fisheries Department initiated a three-year project to develop the fishery resources of the lake. Exotic fish species are being introduced for recreational purposes.

Management Constraints The diversion of flood waters into the wetland causes wide fluctuations in water level and sudden changes in salinity. Although there are no immediate plans to drain the area, the lake is situated in the midst of agricultural land and could be drained at a later date. Fishing activities cause some disturbance to waterfowl, and the harvesting of aquatic vegetation may be excessive. Poaching has declined somewhat since the wetland was declared a wildlife sanctuary.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

KHESHKI RESERVOIR

IUCN Management Category Unassigned

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Lies on the Kabul River, 40km east of Peshawar. 34°02'N, 72°01'E

Date and History of Establishment Designated a Wetland of International Importance at the time of Pakistan's ratification of the Ramsar Convention on 23 July 1976.

Area 263ha

Land Tenure State (Government of North-West Frontier Province)

Altitude 300m

Conservation Value Kheshki is a small water storage reservoir with some fringing reed beds. It is only of minor importance as a staging and wintering area for small numbers of migratory waterfowl. It is so degraded that it is no longer considered a wetland habitat and, therefore, does not merit designation as a Ramsar site. Counts of waterfowl have never exceeded 500, and only 220 birds were recorded in January 1987. Moreover, the lake is polluted with effluents from a nearby paper mill and sugar refinery, and is subject to considerable disturbance from human activities in the area.

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

KHUNJERAB NATIONAL PARK

IUCN Management Category II (National Park)

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Situated 269km north-east of Gilgit, in the former Hunza State. The park lies in the upper Khunjerab and Shimshal valleys in the extreme north-east of the Northern Areas. Its northern and eastern boundaries follow the Pakistan-China border, its southern boundary is delineated by the divides between the upper Shimshal Valley and Hisper and other glaciers while its western boundary is more irregular. Starting at the northern end, the western

boundary includes the Dhi Valley and the mouth of the Ghujerab Valley, then runs eastwards along the divide between the Ghujerab and Shimshal drainages, finally dipping southwards to include the upper Shimshal Valley. 36°50'N, 75°35'E

Date and History of Establishment Designated a national park on 29 April 1975.

Area Officially cited as 226,913ha but this figure is considered to be an underestimate (Wegge, 1988). It is recommended that the park be enlarged in the south-west to include the whole of the Shimshal Valley (Wegge, 1988). The park is adjacent to Taxkorgan Natural Reserve (1,400,000ha) in China.

Land Tenure State (Administration of Northern Areas). Local people enjoy traditional grazing rights.

Altitude Ranges from about 3,200m at the entrances to the park to over 6,000m. Over half of the park is above 4,000m (Wegge, 1988). Khunjerab Pass, the gateway to China via the Karakoram Highway, is at 4,934m.

Physical Features The physiography of the park can be divided into three main parts: in the north, the Khunjerab Valley with its narrow nullahs opens out into undulating meadows near the Pass; in the centre, the Ghujerab River drains the high mountain massifs and glaciers of the Chapchingal and Ghujerab; and in the south, the Shimshal Valley with its many impressive glaciers. The main Khunjerab, Shimshal and Ghujerab rivers flow westwards and drain into the Hunza River. All the waterways are perennial but the upper reaches freeze during the winter fall in temperature. There is a variety of sedimentary, metamorphic and igneous rocks. Soils are generally shallow and immature, containing fragments of rocky material, drifted sand and clay. They are formed mainly by deposition of glacial material carried downstream in large quantities. Soils are deeper in the upper Khunjerab Valley and support good meadows. Cloudbursts and ice-falls from glaciers frequently wreak havoc in the area. Rivers and streams become blocked by debris, and subsequent flooding occurs when the water breaks through these blockades.

Climate The nearest meteorological station is at Misgar, which is about 32km from the park entrance in a separate valley towards the south-west. Conditions vary considerably with altitude. Winter is long and severe and summer is cold and dry. The minimum temperature during winter (December and January) is -12°C. July and August are the hottest months, with a mean temperature of 14°C. Most precipitation falls during the winter.

Vegetation Following the classification of Beg (1975) and Roberts (1977), four main vegetation types can be distinguished. Permanent snowfields and cold desert cover an estimated 25-30% of the park, mainly above 4,000m. The latter is very sparsely vegetated by species such as *Salix* spp., *Potentilla desertorum*, *Mertensia tibetica* and a few grasses and sedges. Alpine meadows (20% total cover) are confined to level ground and depressions above 3,500m and along glaciers. They are generally rich in plant biomass due to an adequate moisture regime and are therefore important food habitats for both domestic and wild herbivores. Sedges and grasses dominate, but forbs such as *Potentilla* spp., *Saxifraga sibirica*, *Primula macrophylla*, *Sedum* spp. and *Polygonum* spp. are also common. Sub-alpine scrub and birch forest (20% total cover) occur as narrow belts along stream bottoms and in ravines throughout most of the altitudinal range of the park. Characteristic species are birch *Betula utilis*, willow *Salix* spp., tamarisk

Myricaria germanica, buckthorn *Hippophae rhamnoides* and water-dependent forbs and graminoids. Alpine dry steppe (15-20% total cover) is found at medium and low elevations on south-facing and dry slopes not covered by sub-alpine scrub and forest. It is sparsely vegetated by junipers *Juniperus* spp. and *Artemisia* spp.

Fauna A total of 15 mammal species is known to reside in the park and several others are likely to be present (Wegge, 1988). Marco Polo sheep *Ovis ammon polii* (I), now one of the rarest mammals in Pakistan, occurs in the vicinity of Khunjerab Pass. According to the Mir of Hunza, the population was around 400 but had dropped to below 180 by the time of the completion of the Karakoram Highway (T.J. Roberts, pers. comm., 1988). A herd of almost 75 Marco Polo sheep was recorded in the spring of 1984 (Islam and Islam, 1984) and park staff saw at least 50 crossing the Pass in May 1989 (P. Wegge, pers. comm.). The species also occurs in the headwaters of Karchanai Nullah in the north-west corner of the park, where 28 females and young were sighted in June 1986 (Nissar Ullah Beg, cited in Wegge, 1988). Pakistan's only population of bharal *Pseudois naysaur* occurs at the western limit of its range in the upper Ghujerab and Shimshal valleys (Schaller, 1974). The Shimshal population had declined to an alarming extent because of hunting (Rasool, 1981), but it has responded to subsequent protection measures and a total of 170 was tallied in 1986 (Rasul, 1986). Wegge (1988) recorded 133 bharal within less than 40 sq. km of the Chatpert drainage, and estimates a total population of 1,500-2,000 animals for the upper Ghujerab, Pamir and Chatpert. Kiang *Equus kiang* used occasionally to visit the Shimshal Pass area from China (Schaller, 1974). There are reliable reports of a small population of 20-25 animals between the lower Baraldo and Mustagh rivers on the Pakistan side of the border (Rasul, 1988; Wegge, 1988). Snow leopard *Panthera uncia* (E) is considered to be common. There is recent indirect evidence that the park supports one of the densest snow leopard populations in Asia (Wegge, 1988). Also present are fox *Vulpes vulpes*, wolf *Canis lupus* (V), which preys on Marco Polo sheep and domestic livestock, brown bear *Ursus arctos*, considered to be threatened with extinction in Pakistan (Schaller, 1974), alpine weasel *Mustela altaica*, over 2,000 ibex *Capra ibex*, widely distributed and abundant in the park but absent from neighbouring China, brown hare *Lepus capensis* and a variety of rodents including long-tailed marmot *Marmota caudata* (Rasool, 1981; Mallon, 1987; Wegge, 1988). There are local reports indicating that wild dog *Cuon alpinus* (V) is present (P. Wegge, pers. comm., 1989).

Mallon (1987) recorded 66 bird species from the park and adjacent area. Additional records are given by Wegge (1988) and T.J. Roberts (pers. comm., 1988). Game birds such as Himalayan snowcock *Tetraogallus himalayensis* and chukar *Alectoris chukar* are common (Rasool, 1981; Wegge, 1988).

Cultural Heritage A useful account of Hunza culture and history is given by Bamber *et al.* (1984). The economy has always been primarily based on subsistence-level farming. With the completion of the Karakoram Highway, the degree of acculturation has been considerable. Since 1970, many people have resettled in Gilgit and men have sought employment elsewhere, some 40% spending 5 years or more away from the Hunza Valley and often in the army. The Aga Khan Foundation, which aims to benefit the religious and secular life of Ishmaeli muslims and the wider community, is having an increasing role in the development of the region and has essentially replaced that of the Mir who traditionally played a central part in Hunza life.

Local Human Population There are no permanent settlements, although a few shepherds move between different localities inside the park throughout the year. The nearest village is Shimshal

on the park boundary, with 120 households and 1,000-1,200 people. Road maintenance gangs live more or less permanently along the Karakoram Highway inside the park. Some 8,000 domestic stock from seven villages south of the park graze its pastures during the summer. Grazing rights in the Dih and Barakhun valleys in the north are allocated by the former Mir. In the Shimshal catchment, there are an estimated 8,000 goats, 2,000 sheep, 1,500 cattle and 500 yaks at a density of 10 animals per sq.km during the three-month summer (Wegge, 1988).

Visitors and Visitor Facilities Khunjerab Valley, accessible from the Karakoram Highway, receives more and more visitors each year, but numbers are still low. Shimshal Valley remains relatively inaccessible and receives 30-50 tourists annually. There are three economy-style lodges/hotels at Passu on the Karakoram Highway. An access road to Shimshal is under construction; when finished, this attractive mountain valley is expected to become very popular among tourists (Wegge, 1988).

Scientific Research and Facilities The wildlife was surveyed in 1974 (Schaller, 1974, 1976). Censuses of large mammal populations have been conducted on a regular basis since 1978 (Rasool, 1981). In autumn 1987 the park was included in a preliminary survey of the large mammals of northern Hunza, as part of Operation Raleigh (Mallon, 1987). Recently, in October-November 1988, Wegge (1988) assessed the status of natural resources and land use practices with a view to identifying management priorities.

Conservation Value The park was established primarily to protect Marco Polo sheep and snow leopard, besides preserving the high mountain environs in a near undisturbed condition. It is also the only known refuge for kiang in Pakistan. With the construction of the Karakoram Highway over the Khunjerab Pass and establishment of Taxkorgan Natural Reserve across the border in 1984, the foundation for an international peace park was laid, giving Khunjerab added conservation significance.

Conservation Management A 12km zone in the vicinity of Khunjerab Pass was closed for domestic stock grazing in order to protect Marco Polo sheep (Rasool, 1981). Little or no development of park infrastructure or management took place until 1988 when a Directorate of Khunjerab National Park was formed as a semi-autonomous organisation within the Forest Department of the Administration of Northern Areas (Wegge, 1988). A workshop was held in the park in 1989 to draft a management plan; this has yet to be finalised. There are plans to develop the park, including 162ha of reforestation (Rasul, 1985). Wegge (1988) suggests that the park be zoned into core, protected and hunting areas, with all activities prohibited in the core zone, grazing and fuelwood collection allowed in protected zones, and controlled hunting and other activities permitted in the hunting zone. The establishment of a hunting programme, including subsistence hunting, would help compensate for restrictions on previous grazing rights. High priority actions identified by Wegge are: cooperating with Chinese authorities for the joint protection of Marco Polo sheep and kiang, controlling hunting and grazing in the 12km protection zone by the Pass, instigating a 'no-stop' regulation for motorists travelling between Kuksil and the Pass (to reduce disturbance to Marco Polo sheep), providing adequate transport and equipment for field staff, and undertaking thorough field studies of Marco Polo sheep and kiang to assess their status and habitat requirements.

IUCN is developing a sustainable forestry project in the upper Hunza Valley as part of the Aga Khan Rural Support Programme (IUCN, 1987). In the long term, this should help to reduce the depletion of forest resources in and around the park.

Management Constraints Some 66km of the Karakoram Highway runs through the park. This has contributed to the decline of Marco Polo sheep, largely as a result of hunting and general disturbance. Further disturbances are anticipated now that Pakistan and China have signed an agreement to establish a trade-free zone on the Chinese side of the Khunjerab Pass. Some pastures are overgrazed, including those within the 12km protected zone where restrictions on livestock have been violated. Illegal hunting still takes place but at insignificant levels, that of Marco Polo sheep by Pakistanis having stopped. Over-collection of fuelwood has also contributed to degradation of vegetation cover in some areas. Snow leopard accounts for a significant offtake of livestock, thought to be about 10% annually. Relatively few snow leopards are killed in retaliation because it is difficult and time-consuming (Wegge, 1988). The construction of a motorable road up the Shimshal Valley will have an enormous impact on the bharal population unless protection measures are adequately enforced. The presence of a permanent police quarters within the park is a source of friction, particularly as police regularly hunt ibex (T.J. Roberts, pers. comm., 1988).

Staff Total field staff is 14, comprising one park ranger, six game watchers and seven chowkidars (Wegge, 1988).

Budget Rs 0.3 million (1985)

Local Addresses Director, Directorate of Khunjerab National Park, Gilgit. (Field staff are stationed at Dih under the charge of a field ranger.)

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- Date** July 1986, updated August 1990

KILIK/MINTAKA GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Hunza, Gilgit District, on the Pakistan-China border, 225km from the town of Gilgit. The northern boundary runs along the international border between Kilik and Mintaka passes. Access is from Misgar Village by bridlepath. Approximately 36°56'N, 75°04'E

Date and History of Establishment Declared a game reserve on 22 November 1975.

Area 65,036ha

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 4,545m to 6,060m.

Physical Features The main north-south-oriented valley is forked, with the Kilik and Mintaka passes lying at the head of each branch. The terrain is rugged and mountainous. There is a variety of sedimentary, metamorphic and igneous rocks, and a mixture of rock and mineral deposits (Rasul, 1985).

Climate Temperatures at higher elevations remain below freezing point for most of the year. Winters are severe, and summers cold and dry. Most precipitation is in the form of snow.

Vegetation Higher altitudes are devoid of higher plants. Lower areas contain patches of *Juniperus*, *Artimesia*, *Haloxylon*, *Salix* and a variety of grasses (Rasul, 1985).

Fauna Large mammals include Marco Polo sheep *Ovis ammon polii* (I), ibex *Capra ibex*, snow leopard *Panthera uncia* (E), brown bear *Ursus arctos*, wolf *Canis lupus* (V) and fox *Vulpes vulpes* (Rasul, 1985). In 1974, only a few Marco Polo sheep from neighbouring China were reported to frequent the vicinity of Kilik Pass. At that time, ibex were the most numerous ungulate with 59 recorded between Murkshi and Kilik Pass (Schaller, 1974). The avifauna includes a variety of game birds, such as chukar *Alectoris chukar*, snow partridge *Lerwa lerwa* and snowcock *Tetraogallus* sp., and raptors and vultures (Rasul, 1985).

Cultural Heritage No information

Local Human Population In 1974, the Kilik Pass area was frequented by some 3,000 head of livestock belonging to the Mir of Hunza and people of Misgar (Schaller, 1974).

Visitors and Visitor Facilities No information

Scientific Research and Facilities The Kilik Pass area was surveyed by Schaller (1974) in November 1974.

Conservation Value The reserve is particularly important as a refuge for Marco Polo sheep, in view of which it has been recommended that the reserve be included within Khunjerab National Park (P. Wegge, pers. comm., 1989).

Conservation Management The area was first proposed as a game reserve, with provision for licensed hunting of Marco Polo sheep and ibex, in an attempt to conserve these species (Schaller, 1974). Wildlife is now afforded full protection. Local people enjoy concessions to collect firewood and graze livestock. There is no management plan, but limited manpower is available for protecting the area (Rasul, 1985).

Management Constraints Marco Polo sheep in particular, and also ibex populations had dwindled by the early 1970s due to severe hunting pressures. In addition, habitat of the former species was heavily disturbed and overgrazed by domestic livestock (Schaller, 1974).

Staff The staff of Khunjerab National Park are responsible for the game reserve.

Budget Included in annual budget for Khunjerab National Park (Rs 0.3 million in 1985).

Local Addresses No information

References

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Date September 1988, updated August 1990

KINJHAR (KALRI) LAKE WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Lies in Thatta District, Sind Province about 113km by road east-north-east of Karachi. Its southern end is about 19km north of the town of Thatta on the Hyderabad Road. 68°03'E, 24°56'N

Date and History of Establishment Declared a wildlife sanctuary in March 1977 under Section 14 of the Sind Wildlife Protection Ordinance, 1972. First protected as a game sanctuary in 1971, under Section 15/1 of the West Pakistan Wildlife Protection Ordinance 1959. The sanctuary was initially surrounded by a buffer zone of 1.6km radius, but this was increased to

5km in July 1975. Designated a Wetland of International Importance at the time of Pakistan's ratification of the Ramsar Convention on 23 July 1976.

Area 13,468ha of lake surrounded by a buffer zone of 5km radius. It has been recommended that the boundaries of the sanctuary should be extended up to the canal along the Thatta-Hyderabad road (Conder, 1977).

Land Tenure State (Provincial Government of Sind)

Altitude 70m

Physical Features This is the largest freshwater lake in Pakistan, having been created from two smaller lakes, namely Kinjhar and Kalri, in the 1930s following the construction of a dam at Chilia Bangla and a 13km-long bund (embankment) along the east side. The lake is set in the stony desert, which is composed of alternating layers of fossil-bearing limestone and sandstone. Higher ground, often forming peninsulas, is usually capped with limestone. Much of the low-lying western shore is predominantly sandstone. Generally, the strike of the limestone beds forming the peninsulas is north-north-east to south-south-west, the beds dipping gently to the west. The eastern sides of the peninsulas feature steep escarpments. The lake is fed from the north-east corner by the KB feeder and by many small seasonal streams on the west and north sides. The only outlet from the lake is through the dam and via the Jam Branch Canal in the south-east corner. There are three seepage lagoons beyond the new canal, constructed in 1976/1977.

Climate Conditions are dry subtropical monsoonal. Mean annual rainfall for the region is 178mm, falling mainly during the monsoon season. Summers are hot, with maximum temperatures reaching 49°C in the shade. Winters are cold with a January mean of 2.2°C. Prevailing winds are north-east in December-January and west-south-west in May-September (Sorley, 1968).

Vegetation Comprises extensive beds of *Phragmites karka*, *Typha angustata* and *Juncus articulatus*, and a rich growth of submerged and floating aquatic vegetation including *Hydrilla verticillata*, *Potamogeton pectinatus*, *P. perfoliatus*, *Polygonum barbatum*, *Nymphaea lotus*, *Vallisneria spiralis* and *Zannichellia palustris*. *Tamarix dioica* grows along the shoreline. The natural vegetation of the region is tropical thorn forest, with species such as *Acacia nilotica*, *A. senegal*, *Commiphora mukul*, *Prosopis cineraria*, *Euphorbia caudicifolia*, *Cenchrus ciliaris*, *Salvadora oleoides* and *Dicanthium annulatum*.

Fauna Mammals known to occur in the area include jackal *Canis aureus*, fox *Vulpes vulpes*, mongoose *Herpestes* sp. and black-naped hare *Lepus nigricollis*.

Some 65 species of waterfowl have been recorded. Breeding species include night heron *Nycticorax nycticorax* (up to 5,000), cotton pygmy goose *Nettapus coromandelianus* (up to 1,290), purple swamphen *Porphyrio porphyrio*, and pheasant-tailed jacana *Hydrophasianus chirurgus*. Mid-winter counts in the 1970s produced totals of between 50,000 and 150,000 waterfowl. Over 135,000 birds were present in January 1987, and over 205,000 in January 1988. Maximum counts include the following: 1,580 great cormorant *Phalacrocorax carbo*, 1,640 little cormorant *P. niger*, 4,500 gadwall *Anas strepera*, 20,500 Eurasian wigeon *A. penelope*, 3,500 common teal *A. crecca*, 1,950 northern pintail *A. acuta*, 1,680 northern shoveler *A. cly-*

peata, 23,000 common pochard *Aythya ferina*, 22,000 tufted duck *A. fuligula*, and 131,000 common coot *Fulica atra*. Many birds of prey have been recorded, marsh harrier *Circus aeruginosus* being particularly common.

Reptiles include cobra *Naja naja*.

The fish fauna is rich and includes *Ambassis nana*, *Badis* sp., *Puntius (Barbus) sarana*, *P. ticto*, *P. sophore*, *Catla catla*, *Channa* sp., *Cirrhinus mrigala*, *Ctenopharyngodon idellus*, *Gadusia chapra*, *Glossogobius* spp., *Labeo rohita*, *L. gonius*, *L. fimbriata*, *Notopterus notopterus*, *N. chitala*, *Rasbora rasbora*, *Tilapia mossambica* and *Xenentodon cancila*.

Cultural Heritage Pir Amir, an Ishmaeli shrine, is a prominent landmark on the northern shore.

Local Human Population There are some 15 villages on the edge of the lake whose inhabitants depend to some extent on fishing for their livelihood (Conder, 1977).

Visitors and Visitor Facilities A tourist complex, comprising rest houses, restaurant and theatre, is being established by the Pakistan Tourist Development Corporation at Hillaya (Conder, 1977).

Scientific Research and Facilities Annual mid-winter waterfowl counts have been conducted since 1971 and the avifauna has been well documented. The zooplankton has been studied, particularly copepods which have a significant role in the food-chain of fishes and other higher consumers (Baqai and Rehona, 1973, 1974).

Conservation Value Kinjhar is an extremely important breeding, staging and wintering area for a wide variety of waterfowl. It is also an important source of drinking water for Karachi and supports a major fishery. Being close to the capital, it offers excellent opportunities for nature-oriented recreation, conservation education and research.

Conservation Management The sanctuary is administered according to a management plan prepared by Conder (1977). Commensurate with the primary management objective of providing Karachi with its freshwater supply, the habitat should be protected for the benefit of the large numbers of resident and migratory birds, particularly waterfowl, and facilities provided for the public to observe and learn more about the wildlife. Hunting is prohibited but not commercial fishing, rights to which are contracted out by the Karachi Development Authority. Bathing and other activities likely to pollute the lake are restricted by the Authority. Conder has recommended that the sanctuary be enlarged to include the three seepage lagoons between RD 10 and 38, and that management activities be concentrated on these lagoons rather than the main lake where fishing is a major disturbance.

Management Constraints Fishing activities are a source of almost continuous disturbance to waterfowl: some of the larger villages have up to 30 boats in operation and there are 56 large circular nets set permanently in the lake. There is also some encroachment by grazing cattle, and an increasing amount of disturbance from recreational activities (Conder, 1977).

Staff It has been recommended that game watchers be replaced by a sanctuary warden, two or three deputy sanctuary wardens and 10 assistant sanctuary wardens, and that a research biologist be appointed (Conder, 1977).

Budget No information

Local Addresses No information

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Date August 1986, updated August 1990

KIRTHAR NATIONAL PARK

IUCN Management Category II (National Park)

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Lies 80km north of Karachi in the south-west of Sind Province, within Karachi and Dadu districts. It comprises the south-east extension of the Kirthar Range, to the west of the River Indus. The western boundary is the provincial border between Sind and Baluchistan. 25°10'-26°05'N, 67°10'-67°55'E

Date and History of Establishment Declared a national park on 31 January 1974 (Government of Sind Notification No. WL & FT (SO1-DCF-993)74). Attempts to restrict the decline in wildlife date back to the Sind Wild Birds and Wild Animals Protection Act of 1940, and possibly even earlier, when game guards were privately employed by families owning land in the Kirthar region. Much of what is now the park was originally classified as government wasteland, but in 1965 that area lying in Karachi District was reclassified as protected forest. Most of the tract was declared a game reserve in 1970 and Murri Mongthar a wildlife sanctuary in 1971. The present area (excluding a small strip of land in the south-west and a block in the north-east corner, to the east of Suk Nai) was declared a wildlife sanctuary on 28 October 1972 under the Sind Wildlife Protection Ordinance, 1972.

Area 308,733ha. The park is part of a 447,161ha protected areas complex, being contiguous with Mahal Kohistan Wildlife Sanctuary (70,577ha) to the south and Hab Dam Wildlife Sanctuary (27,219ha) to the south-west. Surjan, Sumbak, Eri and Hothiano Game Reserve (40,632ha) lies just to the east of the park.

Land Tenure State (Provincial Government of Sind). In 1972, 66,793ha of land were leased by the government for cultivation and stock grazing and 35,874ha were privately owned (Holloway and Khan, 1973). The present status of these lands is not known.

Altitude Ranges from about 70m at Hab Dam to 1,004m on Karchat Mountain, which is at the south-eastern extremity of the Kirthar Range.

Physical Features Comprises a number of north-south-aligned hill ranges separated by wide, undulating valleys. Drainage in the north and central sectors follows a south-westerly direction via the Baran Nadi to the Indus River and thence to the Arabian Sea. The west-central and south-west regions are drained by the Mahr and Hab rivers, respectively, which follow a southerly course to the sea. Principal geological formations are calcareous. Limestone predominates in the hill ranges and recent calcareous deposits are common in the valleys. Sandy limestones, shales, sandy shales and sandstones also occur throughout the range, particularly in the south-west and lower foothills. Grey sandstones occur together with limestone in the north-east. Underground water, which has been tapped in many places, tends to be brackish in limestone and fresh in sandstone formations. The abundance of foraminiferous, lamellibranch, echinoid, gastropod and arthropod fossils is evidence that the Kirthar Range once formed the bed of the Tethys Sea. Soils contain fragments of rocky material, much of which is limestone. They contain about 90% sand and 10% clay at the surface. Considerable erosion has occurred on the plateaux, hill flanks and plains but good soil depths remain in the valleys and depressions protected from wind or running water.

Climate There are four climatic seasons: winter (December-March), summer (April-June), monsoon (July-September) and autumn (October-November). There is no meteorological station within the park but data are available from nearby at Thano Bula Khan, for the period March 1955 to September 1959, and from Hyderabad. Mean annual precipitation is 150-200mm, most rain falling in July and August. Drought conditions, with less than 25mm of rain, occur at least once every ten years and during 1979-1982 no rain was recorded in the park. Temperatures are often extreme, exceeding 38°C during most of the summer in Thano Bula Khan. Humidity is lowest in summer and highest in the monsoon. Strong, dry and dessicating winds prevail during much of the year, except in July and August (Holloway and Khan, 1973). Plans are underway to establish one or two meteorological stations at Karchat or Khar.

Vegetation Open communities of deciduous xerophytic trees and shrubs are predominant. Three principal communities have been recognised: *Acacia arabica-Indigofera oblongifolia-Zizyphus nummularia*, a post-climax, closed community that often occurs on mesic sites such as seasonally-flooded depressions; *Capparis decidua-Prosopis spicigera-Commiphora mukul*, a climax community which occurs on sites with deep sandy soils with weak structure and low calcium, magnesium and carbonate content at the surface; and *Euphorbia caudicifolia-Grewia tenax-Acacia senegal*, a sub-climax community associated with shallow loamy soils, with low carbonate and high potassium content. There is evidence that this region was fairly humid and supported tropical forest up until about 500 BC (Holloway and Khan, 1973). In common with arid regions in general, species diversity is relatively low. Holloway and Khan list some of the trees, shrubs and herbs found in the park.

Fauna Some 30 species of mammals have been recorded (W.D. Edge, pers. comm., 1987), of which 26 are listed by Holloway and Khan (1973). There is a good variety of predators but larger species are either extremely rare, such as the wolf *Canis lupus* (V) and striped hyaena

Hyaena hyaena, or may have become locally extirpated, such as leopard *Panthera pardus* (T) (the last leopard was shot in 1977) and caracal *Felis caracal*. Approximately 500 wild goat *Capra hircus* occurred on Karchat Mountain in 1970-1971, out of an estimated total population of 1,200 in the park and nearby Surjan, Sumbak, Eri and Hothiano Game Reserve. About 70 urial *Ovis orientalis* were recorded on the Murri Mongthar mountain ranges in 1971 and small numbers on Karchat, Dunbar and Kambhu mountains. Chinkara *Gazella gazella* occurred in low numbers on the plains and hill flanks. In 1977, 1,480 wild goat and 430 urial were counted in the park and 2,141 chinkara in the park and adjacent Surjan, Sumbak, Eri and Hothiano Game Reserve (Mirza and Asghar, 1980). There are now over 5,000 wild goat, about 1,250 urial and less than 150 chinkara in the park, and a further 400 wild goat and 70 urial in the game reserve (M. Woodford, pers. comm., 1990).

Of the 58 species of birds identified by T.J. Roberts (Holloway and Khan, 1973), long-legged buzzard *Buteo rufinus*, Bonelli's hawk-eagle *Nisaetus fasciatus*, imperial eagle *Aquila heliaca*, tawny eagle *Aquila rapax*, cinereous vulture *Aegypius monachus*, griffon vulture *Gyps fulvus*, lammergeier *Gypaetus barbatus*, laggar falcon *Falcon biarmicus*, red-headed merlin *Falco chicquera*, kestrel *Falco tinnunculus*, see see partridge *Ammoperdix griseogularis*, grey partridge *Francolinus pondicerianus*, stone curlew *Burhinus oedipnemus*, Indian sand grouse *Pterocles exustus*, coronetted sand grouse *P. coronatus*, painted sand grouse *P. indicus*, eagle owl *Bubo bubo*, Sind pied woodpecker *Dendrocopos assimilis*, Hume's chat *Oenanthe alboniger*, brown rock pipit *Anthus similis* and striped bunting *Emberiza striolata* are noteworthy. Golden eagle *Aquila chrysaetos* has also been recorded (T. J. Roberts, pers. comm., 1986). Apart from ocean birds and many waterfowl, most species recorded by Roberts *et al.* (1986) in the Karachi and lower Sind area occur in the park.

Freshwater turtles (Trionychidae) probably still occur in Hab River and starred tortoise *Geochelone elegans* inhabits the Hab Valley. Other reptiles likely or known to be present are Dunsterville's gecko *Stenodactylus orientalis*, garden lizard *Calotes versicolor*, spiny-tailed lizard *Uromastix hardwickii*, red-throated agama *Agama rubigularis*, desert monitor *Varanus griseus* (V), yellow monitor *V. flavescens*, three-toed skink *Mabuya macularia*, Indian python *Python molurus* (V), saw-scaled viper *Echis carinatus*, Sind krait *Bungarus caeruleus* and royal rat snake *Spalerosophis diadema*. Mugger *Crocodylus palustris* (V) is almost extinct from the stretch of the Hab River bordering the park but it survives further upstream in Baluchistan (Holloway and Khan, 1973). There are about 100 mugger in Hab Dam, where there are tentative plans to establish a commercial crocodile farm (M. Woodford, pers. comm., 1990). Other reptiles recorded by W.D. Edge (pers. comm., 1987) include common monitor *Varanus bengalensis*, Indus toad *Bufo andersoni*, skittering frog *Rana cyanophlyctis*, warty rock gecko *Gymnodactylus kachhensis*, Persian gecko *Hemidactylus persicus*, Indian fringe-bed sand lizard *Acanthodactylus cantoris*, brilliant agama *Agama agilis*, *A. nupta*, Afro-Asian sand snake *Psammophis schokari*, Indian sand boa *Eryx johni*, Mediterranean dwarf skink *Ablepharus pannonicus* and orange-tailed skink *Eumeces schneideri*.

Despite their seasonality, few of the larger rivers ever dry up completely. Thus fish and other aquatic life are able to survive the dry season in deep pools of water which collect at bends and depressions in the river bed. A number of species of fish, principally of the carp Cyprinidae family, have been recorded from the Kirthar Range (Holloway and Khan, 1973).

Cultural Heritage Archaeological remains of habitation near Koh-Tarash date back to pre-Islamic and even pre-historic periods (3500BC). The presence of a number of tombs at

Taung, similar in design to those at Makli Hills in southern Sind, suggests that the area has been settled for at least several hundred years. Rannikot Fort, covering an area of about 47 sq.km in the north-eastern tip of the park, is reputedly the largest fort in the world and provides a remarkable example of the defence system of the late Muslim rulers of Sind (Haleem and Khan, n.d.).

Local Human Population In 1989 the resident human population in the park was approximately 16,000, distributed among 118 permanent villages, and about 64,000ha of park land was under cultivation (M. Woodford, pers. comm.). This is significantly higher than in the early 1970s when the resident population totalled about 10,500, with an additional 3,000 migrant herdsmen present from July/August until November/December. At that time there were 93 permanent villages in the park and a further 124 settlements temporarily occupied by herdsmen for part of the year. Stock grazing was the most widespread form of land use and greatly in excess of carrying capacity. In the post-monsoon season of 1971 domestic livestock totalled 27,749 cows, 588 buffalo, 77,497 sheep, 86,277 goats, 5,731 camels, 1,480 donkeys and 226 horses. Some 102,667ha of land was privately owned or leased from the government, of which 114ha were under permanent cultivation and the rest subject to shifting cultivation (Holloway and Khan, 1973).

Visitors and Visitor Facilities Despite its proximity to Karachi, the park receives only 2-3 visitors per month (M. Woodford, pers. comm., 1990). The best season to visit is from mid-October to mid-March. There are visitor centres at Karchat and Khar, both of which are run by the Sind Wildlife Management Board. The centres offer cottage and dormitory accommodation and guides are available. There are some 671km of unmetalled roads within the park, most of which are negotiable only by four-wheel drive vehicle.

Scientific Research and Facilities The behaviour and ecology of the wild goat and urial have been studied (Schaller and Laurie, 1974; Edge and Olsen-Edge, 1989; Edge *et al.*, 1989, in press). Wildlife counts, initiated by the Forest Department in 1970, are still undertaken. The fossil fauna has been studied by the Geology Department of the University of Sind. Extensive botanical collections have been made within the park and its environs, notably by the University of Karachi. An ecological survey of the park was begun in 1981 with financial support from WWF-Pakistan (Ahmad, 1982). There are no research facilities but accommodation is available for visiting scientists.

Conservation Value Kirthar is an area of outstanding beauty and cultural heritage which provides important habitat for a variety of mammals, birds and reptiles characteristic of the arid subtropics.

Conservation Management There is an out-of-date management plan, according to which management objectives are: to conserve native fauna, flora and scenic features in perpetuity; and to promote regulated use of the natural resources and historic cultural sites for aesthetic, educational, recreational and scientific purposes. A system of zonation has been recommended, with zones of varying intensity of use by visitors buffered by wildlife sanctuaries and a game reserve (in which controlled hunting should be allowed) on the periphery. Full protection of core areas in the mountainous region, including cessation of grazing by domestic livestock, has enabled the habitat and its ungulate populations to recover. It is recommended that residents should ultimately be provided with the opportunity to move to better managed rangelands or cultivated areas peripheral to the park; meanwhile, to prevent encroachment by outsiders, no

further extension of land under cultivation should be allowed (Holloway and Khan, 1973; Kermani and Khan, 1985). Resettlement is now considered unrealistic; a more appropriate strategy might be to re-define the park's boundaries in the light of prevailing socio-economic constraints (M. Woodford, pers. comm.). Assistance from World Bank may be forthcoming as part of a possible environmental programme in Pakistan.

In October 1984, 15 blackbuck *Antelope cervicapra* from the USA were brought to Khar visitor centre for captive propagation (Haleem and Khan, n.d.). It is planned to introduce the species to the park but most potential blackbuck habitat is overused by the human population (M. Woodford, pers. comm., 1990).

Management Constraints In the past, considerable damage has been caused by cultivation, overgrazing, wood cutting and overhunting. Encroachment has been controlled in the more strictly preserved mountainous region, but elsewhere it remains a serious problem.

Staff Office staff comprise a park director, an assistant and four others. Field staff total two park managers, two park rangers and 102 others including wildlife watchers (1989).

Budget Rs 900,000 per year (approximately US\$ 8,500) in 1981. The development plan as envisaged will cost Rs 24,500,000 (Kermani and Khan, 1985).

Local Addresses Park Director, Kirthar National Park, Karchat

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Date July 1986, updated August 1990

LAL SUHANRA NATIONAL PARK

IUCN Management Category V and IX (Protected Landscape and Biosphere Reserve)

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Lies in the south-east of Punjab Province, 32km north-east of Bahawalpur City along the Bahawalpur-Bahawalnagar road, from where the park is accessible. Approximately 27°30'N, 72°20'E

Date and History of Establishment Declared a national park on 26 October 1972 (Government of Punjab Notification No. SOF (EXT)XII-23/72), following recommendations made by the Wildlife Enquiry Committee in 1971. The plantation has been a reserved forest since 5 July 1947 although its legal status appears to be uncertain (Masud, 1980). The Cholistan Desert was originally preserved as a hunting ground by the nawabs of the former state of Bahawalpur. Subsequently, in 1968, it was declared a game reserve. Designated a biosphere reserve in 1977.

Area 37,426ha. Originally, the park comprised an area of 31,355ha, of which 20,932ha were desert, 8,488ha irrigated forest plantation and 1,934ha reservoir (Masud, 1980); it was due to be enlarged by 22,680ha.

Land Tenure State (Provincial Government of Punjab)

Altitude 110m

Physical Features The Cholistan Desert is relatively flat and interspersed with sand dunes up to 1,000ha in extent and 4m in height, some of which are unstable. It is crossed by the dried-up bed of the Hakra River and features an important wetland, Patisar Lake (see Scott, 1989 for further details). The lake (1,935ha), originally built as a storage reservoir, is fed by the Desert Branch of the Bahawal Canal and also receives excess water from irrigated land nearby. The depth of the water table (3-12m below ground level) varies directly with the distance from Bahawal Canal. Soils are predominantly sandy loam, with clay flats (dhars) between the sand dunes (Masud, 1980).

Climate Conditions are arid subtropical/continental, characterised by low sporadic rainfall, hot summers, low relative humidity, high evaporation rates, strong summer winds and mild winters. There are five distinct seasons: winter (December-February), spring (March-April), summer (May-October), autumn (November) and monsoon (July and August). Climatic data are available from Bahawalpur. During the period 1946-1962, mean annual precipitation was 214mm, mean monthly maximum temperature highest (46.1°C) in May and mean monthly minimum temperature lowest (-0.2°C) in January (Masud, 1980).

Vegetation The main plant communities include tropical thorn forest, dominated by *Acacia nilotica*, *Suaeda-Salsola* scrub and riverine *Tamarix* forest. The plantation, which is irrigated by the Desert Branch of the Bahawal Canal, consists mainly of shisham *Dalbergia sisso*, together

with toot *Morus alba*, kikar *Acacia arabica*, frash *Tamarix articulata*, jal *Salvadora oleoides*, jand *Prosopis spicigera*, karir, and jandi *Prosopis glandulosa*. Of the numerous herbs, khubal *Cynodon dactylon* and puth kanda *Achyranthes aspera* are important. Dense stands of kana *Saccharum spontaneum* grow along the margins of Patisar Lake and *Salvinia natans* covers much of the shallower waters (Sheikh, 1982). Some 135 species of plants have been recorded in the park, 39 of which are known for their medicinal properties (Anon., n.d.).

Fauna Blackbuck *Antelope cervicapra* became virtually extinct in the Cholistan Desert but the species has been re-introduced within large enclosures, together with chinkara *Gazella gazella*, nilgai *Boselaphus tragocamelus*, hog deer *Cervus porcinus* and Indian rhinoceros *Rhinoceros unicornis* (Roberts, 1975; Sheikh, 1982). Other mammals present include long-eared hedgehog *Hemiechinus auritus*, wolf *Canis lupus* (V), jackal *C. aureus*, Bengal fox *Vulpes bengalensis*, fox *V. vulpes*, ratel *Mellivora capensis*, otter *Lutra perspicillata*, small Indian civet *Viverricula indica*, Indian grey mongoose *Herpestes auropunctatus*, caracal *Felis caracal*, jungle cat *F. chaus*, desert cat *F. libyca*, wild boar *Sus scrofa*, Indian crested porcupine *Hysterix indica* and black-naped hare *Lepus nigricollis* (Masud, 1980).

Patisar Lake regularly holds between 10,000 and 30,000 ducks and common coot *Fulica atra* in mid-winter. Over 13,00 waterfowl were present in January 1987, of which the most numerous species were mallard *Anas platyrhynchos* (1,410), common pochard *Aythya ferina* (4,500) and common coot (5,300) (Scott, 1989). The lake used to support a small population of marbled teal *Marmaronetta angustirostris* but this duck has not been seen in the area for many years. An unsuccessful attempt was made to re-introduce the species in 1970 using birds provided by the Waterfowl Trust, Slimbridge, UK (Bokhari, 1970b). The park supports a large population of birds of prey including osprey *Pandion haliaetus*, Pallas's fish eagle *Haliaeetus leucoryphus*, marsh harrier *Circus aeruginosus*, greater spotted eagle *Aquila clanga*, imperial eagle *A. heliaca*, and tawny eagle *A. rapax*. Noteworthy land birds include great Indian bustard *Ardeotis nigriceps* (V), a rare resident, and houbara bustard *Chlamydotis undulata*, a winter visitor (Scott, 1989). Over 160 species have been recorded by T. J. Roberts (pers. comm., 1986).

Reptiles include turtles, tortoise, monitors *Varanus* spp., lizards of the genus *Calotes*, cobra *Naja naja*, saw-scaled viper *Echis carinatus*, krait *Bungarus* sp., watersnake, gamasnake *Boiga* sp., wolfsnake *Lycodon* sp. and John's sand boa *Eryx johni*.

The lake contains large fish populations of carp (Cyprinidae), catfish (Siluriformes), catla *Catla catla*, murrel *Ophicephalus marulius*, rohu *Labeo rohita*, mullet *Vallago attu*, mirgal *Cirrhitina mirgala* and trikanda *Rota rita*. Other species known to occur are listed by Scott (1989).

Cultural Heritage There are archaeological remains of an ancient civilization which once flourished along the Hakra River.

Local Human Population About 20 families cultivate some 810ha of land in the vicinity of Patisar Lake.

Visitors and Visitor Facilities There is a visitor centre and children's park near the main entrance. Overnight accommodation is available at Hermitage Rest House by the reservoir, the Irrigation Department's lodge on Whispering Hill and at the new tourist hut beside the Desert Branch Canal. Other facilities include four camp sites, two watch towers, two fishing sites and boating on the lake (Masud, 1980; Shah, 1984).

Scientific Research and Facilities The availability and selection of food by blackbuck has been studied (Mirza and Waiz, 1973). A study of the behaviour of chinkara and blackbuck is in progress, jointly supported by Punjab Government and US Fish & Wildlife Service. Preliminary observations have been made on houbara bustard (Mirza, 1985).

Conservation Value The area was first identified as being suitable for breeding blackbuck and as an important wetland site in 1966 (Mountfort and Poore, 1967), since when its conservation status has progressively been upgraded. Patisar Lake is a very important wintering area for waterfowl, particularly ducks, and a staging ground for large numbers of birds, especially in autumn (Scott, 1989).

Conservation Management The park is fully protected; furthermore, hunting and cutting of vegetation is prohibited within a 5km radius of the park's boundary (Sheikh, 1982). It is managed according to objectives outlined in the master plan (Masud, 1980). These include protecting and restoring the endemic fauna and flora, providing recreational and educational facilities for the local people (and also for tourists) and accommodating scientific research. A system of zonation has been proposed, whereby the entire Cholistan Desert is incorporated within a wilderness zone in which development is not permitted, enclosures established for the blackbuck breeding programme are included within special areas to which entry is restricted, and the Desert Branch Canal is encompassed within recreation zones of varying intensities of use. A new management plan has since been prepared by Khan and Chaudhry (1987) and submitted to the authorities for approval. The plantation is being managed for commercial purposes according to objectives outlined in the working plan (Qazi, 1967). Of the additional 5,100ha earmarked plantation by 1987/88, 1,862ha has already been planted with trees (Shah, 1984).

A programme to re-introduce blackbuck to the park began in 1970 with an initial shipment of 10 animals (seven females and three males) from a Texas ranch. (These blackbuck were the descendants of 35 blackbuck presented to Texas in 1940 by the late Amir of Bahawalpur.) Survival of young proved to be low and so, in 1980, a further five females and one male, donated by Copenhagen Zoo, were added to the stock, since when numbers had increased to some 48 by 1982. Another breeding nucleus was established in a separate enclosure in 1982 with animals from Copenhagen Zoo and Western Plains Zoo, New South Wales (Ahmad, 1983; Aleem, 1978; Sheikh, 1982).

Management Constraints The plantation comprises mostly introduced species, including the dominant shisham, toot, simal *Salmalia malabaricum* and *Eucalyptus* spp.. Problems of encroachment exist in several places and some areas continue to be cultivated. The reservoir could be expanded in the future with the increased demand for water to irrigate the Cholistan Desert as it becomes more extensively populated (Masud, 1980).

Staff Comprises an administrator with an office wing of 11 staff, a forestry wing of 71 staff (including one divisional forest officer, three range officers, 10 foresters and 18 forest guards) and a wildlife wing of 12 staff (including one assistant game warden, one game inspector, three game watchers and two fishery watchers) (Shah, 1984).

Budget No recent information. Rs 5,368,000 were provided by the provincial government for the period 1975/76 to 1978/79.

Local Addresses Administrator, Lal Suhanra National Park Head Office, Bahawalpur, Punjab Province

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LANGH (LUNGH) LAKE WILDLIFE SANCTUARY

IUCN Management Category UA

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Situated in Sind Province, 19km west of Larkana from which it is accessible by metal road. An unmetalled road runs along the northern and western boundaries of the sanctuary and in one part actually passes through it. 68°03'E, 27°30'N

Date and History of Establishment Declared a wildlife sanctuary 1972 (Notification No. 26(2) SWL & FT/72) and re-notified in 1980.

Area 19ha (formerly lake) surrounded by a 47ha buffer zone of 5km radius

Land Tenure Land within the sanctuary belongs to the state (Provincial Government of Sind), which in 1977 was in the process of purchasing the surrounding buffer area from private landowners.

Altitude 50m

Physical Features The lake was formerly part of the Indus river-bed, now 32-48km to the east. It lies in the fertile silt soils (comprising about 20% sand and 80% clay and silt) of the Indus flood plain. The area of open water is 20-30m across. Land surrounding the lake is generally flat, with the limestone and sandstone hills of the Kalat Range some 80km to the west in Baluchistan. The flood plain is divided into small fields, which are irrigated by a network of canals and used mainly for growing rice. The lake is fed by monsoon rain, and water also enters *via* a small canal to the north. Apparently there is no outlet channel. The boundary of the sanctuary is partly surrounded by a bund which helps to retain the water. Parts of the lake normally dry out in the summer months.

Climate Conditions in the region are extreme, with temperatures reaching 47°C in the shade in summer and falling to a mean minimum of 2.2°C in January. Mean annual rainfall is about 178mm, most of which falls in the monsoon season. Prevailing winds are north-east in winter and west-south-west in May-September (Sorley, 1968).

Vegetation There were three principal habitat types: open water, formerly the arm of the Indus, with stands of *Typha angustata* and *Juncus* spp. on the edge; swamp, dominated by *Tamarix dioica*; and areas dominated by *Juncus* spp. which were rice fields prior to being flooded in the early 1960s (Conder, 1977). In recent years, water supplies have been diverted for use elsewhere and the lake has become completely overgrown with *Typha* and *Tamarix* (Scott, 1989).

Fauna The lake used to support very large numbers of waterfowl in addition to large populations of non-migratory species and Palaearctic migrant warblers of the genera *Acrocephalus*, *Hippolais*, *Phylloscopus* and *Sylvia* (Conder, 1977). Up to 200 mallard *Anas platyrhyn-*

chos, 25,000 common teal *A. crecca*, 200 garganey *A. querquedula*, 500 gadwall *A. strepera*, 19,000 northern pintail *A. acuta*, 8,000 northern shoveler *A. clypeata*, 40 marbled teal *A. angustirostris* (one of the rarest Palearctic ducks to visit the Indian subcontinent), 50 tufted duck *Aythya fuligula*, 3,000 common pochard *A. ferina* and the occasional ferruginous duck *A. nyroca* were recorded during counts in 1973-1977. The lake was also important for other waterbirds, notably night herons *Nycticorax nycticorax*, with up to 1,100 recorded. Other species included great cormorant *Phalacrocorax carbo*, Indian cormorant *P. fuscicollis*, little cormorant *P. niger*, darter *Anhinga anhinga*, grey heron *Ardea cinerea*, purple heron *A. purpurea*, pond heron *Ardeola grayii*, great egret *Egretta alba*, intermediate egret *E. intermedia*, little Egret *E. garzetta*, glossy ibis *Plegadis falcinellus*, as well as a variety of waders including painted snipe *Rostrulata benghalensis*, white-tailed plover *Chettusia leucurus* and pheasant-tailed jacana *Hydrophasianus chirurgus*. Birds of prey included osprey *Pandion haliaetus*, greater spotted eagle *Aquila clanga*, imperial eagle *A. heliaca*, tawny eagle *A. rapax*, white-tailed eagle *Haliaeetus albicilla*, Brahminy kite *Haliastur indus*, black kite *Milvus migrans*, long-legged buzzard *Buteo rufinus*, pallid harrier *Circus macrourus*, marsh harrier *C. aeruginosus* and saker falcon *Falco cherrug*. The *Tamarix* area was an important wintering ground for many smaller birds, including Palearctic warblers. Nothing has been documented about the other fauna. The only waterfowl present in January 1987 were 27 herons and egrets and 12 shorebirds. In January 1988, there were about 200 birds, mainly cormorants, herons and egrets (Scott, 1989).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities There is one rest house.

Scientific Research and Facilities The waterfowl has been regularly censused since the early 1970s. There are no research facilities.

Conservation Value The lake was an important staging and wintering area for a wide variety of waterfowl (Conder, 1977), but the wetland has almost completely disappeared and it is no longer of importance to waterfowl (Roberts, 1984; Scott, 1989).

Conservation Management A management plan was prepared by Conder (1977), according to which objectives were: to conserve and protect the natural habitat to provide optimal conditions for the large numbers of resident and wintering birds, particularly waterfowl; to provide for a limited amount of shooting on special occasions; and to provide facilities for scientists, naturalists and interested members of the public to study and enjoy the wildlife without disturbing it.

Management Constraints The lake has shrunk considerably in area as it is no longer maintained by regularly diverting water. Disturbance by grazing livestock is excessive.

Staff Honorary district game warden, game inspector and game watchers (1977)

Budget No information

Local Addresses Divisional Forest Officer, Larkana, Sind Province

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- Date August 1986, updated August 1990

MACHIARA GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Lies in Muzaffarabad District of Azad State of Jammu & Kashmir. 34°31'-34°34'N, 73°32'-73°39'E

Date and History of Establishment Declared a game reserve in 1982.

Area 13,537ha

Land Tenure State (Azad State of Jammu & Kashmir). Traditional grazing rights are exercised by the local people.

Altitude Ranges from 2,134m to the peak of Mushan at 4,733m (Roberts, 1984).

Physical Features The sanctuary encompasses the watershed of Machiara Nullah, a tributary of the Neelum River.

Climate Conditions are temperate. Meteorological data are available from Naran which lies at about 1,000m in the adjacent Kaghan Valley. Here, annual precipitation is 1340mm, of which almost 60% falls between February and April. Mean monthly maximum and minimum temperatures range from 3.3°C and -6.9°C, respectively, in January to 25.6°C and 12.6°C in August (Khan, 1989).

Vegetation Deciduous forest occurs at lower altitudes (2,400-2,800m). It is dominated by almost pure stands of horse chestnut *Aesculus indica*, with the occasional walnut *Juglans regia*, ash *Fraxinus* sp., and maple *Acer caesium*, and an understorey of *Parrotiopsis jacquemontiana*, *Jasminium humile* and *Berberis* spp. Middle altitudes support dense mixed forests, with oak *Quercus semecarpifolia* on more exposed ridges (near the westernmost limit of this Himalayan oak) and a dense shrub layer of *Lonicera webbia*, *Abelia triflora*, *Viburnum cotinifolium* and *V. nervosum* in the steeper ravines. Cedar *Cedrus deodara* grows alongside blue pine *Pinus excelsa* on drier southern slopes, and silver fir *Abies pindrow* and spruce *Picea smithiana* occur on northern or moister slopes. Birch *Betula utilis* is predominant above 3,300m, with extensive

patches of creeping juniper *Juniperus communis* and, in damper areas, dense clumps of willow *Salix denticulata*. Alpine pastures, with patches of dwarf rhododendron *Rhododendron anthopogon*, extend to the snowline (Roberts, 1984; Duke, 1988).

Fauna Machiara is noted for its diverse fauna. Large mammals include common langur *Presbytis entellus*, yellow-throated marten *Martes flavigula*, leopard *Panthera pardus* (T), brown bear *Ursus arctos*, Himalayan black bear *Selenarctos thibetanus*, Himalayan musk deer *Moschus chrysogaster* (V), and ibex *Capra ibex*. Rhesus macaque *Macaca mulatta*, wolf *Canis lupus* (V), and snow leopard *Panthera uncia* (E) are also reported to be present (Roberts, 1984; Grimmett, 1987; Duke, 1988).

Roberts (1984) and Duke (1988) each recorded some 40 species of birds during brief surveys, but most Western Himalayan species are likely to be found in the reserve (G. Duke, pers. comm.). Machiara is the second most important known refuge of western tragopan *Tragopan melanocephalus* (E). Islam and Crawford (1987) recorded a minimum of 22 birds within their 8 sq.km study area. Koklass pheasant *Pucrasia macrolopha*, Himalayan monal *Lophophorus impejanus*, possibly cheer pheasant *Catreus wallichii* (E) and snow partridge *Lerwa lerwa* are also present (Roberts, 1984; Duke, 1988).

Cultural Heritage No information

Local Human Population Machiara Village lies outside the reserve, but there are a number of temporary settlements on the periphery and within the reserve which are used by Bakarwal herdsmen during the summer months (Roberts, 1984; Duke, 1988).

Visitors and Visitor Facilities None

Scientific Research and Facilities The wildlife has been briefly documented by Roberts (1984), Grimmett (1987) and Duke (1988). Pheasant populations were censused by Qayyum (1980) in 1977-1979. More detailed studies of the western tragopan have been conducted by Islam (1983, 1985, 1987) and Islam and Crawford (1984-1985, 1987).

Conservation Value Machiara is considered to be one of the most important protected areas in Pakistan. Its Himalayan forests are relatively intact and support a diverse assemblage of faunal species characteristic of the temperate zone. The reserve is a particularly important refuge for the endangered western tragopan, and also for Himalayan musk deer (Roberts, 1984).

Conservation Management There is no management plan for the reserve. The wildlife wing of the Provincial Forest Department, aware of the international importance of Machiara, is planning to upgrade the reserve to wildlife sanctuary status. Plans have stalled due to difficulties with settling existing grazing, felling and shooting rights (Grimmett, 1987; Duke, 1988). It has been recommended that ultimately Machiara should be extended as far east as Kuttan and designated a national park, both to provide a large enough area to support a viable population of western tragopan and to serve as a corridor for the species to disperse to and from the Kaghan and Neelum valleys to the west and east, respectively (Grimmett, 1987; Islam and Crawford, in press). Machiara is included in the ICBP/Pakistan Himalayan Jungle Project, which will focus on core area protection, associated rural development, training of wildlife staff and conservation education (G. Duke, pers. comm., 1990).

Management Constraints The activities of graziers result in considerable disturbance to the vegetation and wildlife within the reserve (Roberts, 1984; Duke, 1988).

Staff One wildlife watcher

Budget No information

Local Addresses Range Officer, Forest Office, Muzaffarabad, Azad Jammu & Kashmir

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Date August 1990

MALUGUL DHAND

IUCN Management Category Unassigned

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Lies in the Kurram River valley about 20km north-west of Lakki in Bannu District. 32°46'N, 70°51'E

Date and History of Establishment Malugul Dhand has no protected status but was designated a Wetland of International Importance at the time of Pakistan's ratification of the Ramsar Convention on 23 July 1976.

Area 405ha

Land Tenure State (Government of North-West Frontier Province)

Altitude 305-390m

Physical Features Malugul Dhand is a dead arm of the Kurram River which fills up during the spring floods to form a shallow brackish/saline lake, about 1m deep. The lake usually dries up during the dry season. The wetland also receives some water from seepage of nearby irrigation canals. The pH value is 8.5.

Climate Conditions are dry subtropical, with very hot summers and cold winters. Mean maximum temperature in June is 42°C, and mean minimum in January is 0.5°C. Mean annual rainfall is 338mm.

Vegetation Dominant aquatic plants include *Typha angustata*, *Phragmites karka*, *Trigonella monantha*, *Phyla nodiflora* and species of *Chara*, *Chenopodium* and *Cyperus*. Woodland in the area is dominated by *Prosopis cineraria* and *Tamarix aphylla*.

Fauna Up to 350 ducks, mainly wigeon *Anas penelope*, teal *A. crecca*, mallard *A. platyrhynchos* and pintail *A. acuta*, have been recorded at Malugul Dhand in mid-winter, along with small numbers of white stork *Ciconia ciconia*, black-winged stilt *Himantopus himantopus* and several other species of shorebirds.

Cultural Heritage No information

Local Human Population Most of the land surrounding Malugul Dhand is cultivated.

Visitors and Visitor Facilities Malugul Dhand is a popular area for outdoor recreation.

Scientific Research and Facilities The Pakistan Forest Institute carried out mid-winter waterfowl counts at Malugul Dhand in 1979 to 1981, and the Zoological Survey Department has conducted annual counts since then.

Conservation Value Malugul Dhand is important for waterfowl. It also provides opportunities for outdoor recreation, including sport hunting.

Conservation Management The wetland is managed by the provincial Wildlife Department.

Management Constraints Numbers of waterfowl have fallen drastically in recent years due to livestock grazing and recreational activities. Salinity levels have increased as a result of extensive irrigation in the area.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

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Date August 1990

MANSHI WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Kaghan Valley on the east bank of the Kunhar River, 12km north of Paras Village in Hazara District, North-West Frontier Province. It is close to the border with Azad State of Jammu & Kashmir. The sanctuary is accessible via Paras along a very poor track, which is impassable during winter snow. 34°48'N, 73°34'E

Date and History of Establishment Declared a wildlife sanctuary in 1977. Originally designated a reserve for a five-year period ending in 1973.

Area 2,321ha. Forms part of Manshi Reserved Forest.

Land Tenure State (Government of North-West Frontier Province)

Altitude Exceeds 4,000m

Physical Features The Kaghan Valley, through which flows the Kunhar River, is steep-sided and aligned north-south. Surrounding ridges form a natural amphitheatre, opening to the south and broken only in the north-west where a side valley leads up to Mount Musa-ka-Mussallah.

Climate No information

Vegetation Lower Kaghan Valley is characterised by Himalayan moist temperate forest, with oak *Quercus dilatata*, sycamore *Acer caesium*, poplar *Populus ciliata*, yew *Taxus baccata* and walnut *Juglans nigra* predominant and some scattered blue pine *Pinus wallichiana*, cedar *Cedrus deodar*, spruce *Picea smithiana* and silver fir *Abies alba*. This vegetation type is replaced by dry temperate coniferous forest in the upper reaches, where blue pine forest is interspersed with cedar, spruce and silver fir. Above 2,500m are alpine meadows, with a rich herbaceous flora, including an abundance of peony *Paeonia* sp. (Wayre, 1971; Roberts, 1977).

Fauna The mammals have not been surveyed, but are known to include common langur *Presbytis entellus* and Royle's pika *Ochotona roylei* (Wayre, 1971). Himalayan black bear *Selenarctos thibetanus*, Himalayan musk deer *Moschus chrysogaster* (V) and occasionally leopard *Panthera pardus* (T) are also present (M.M. Malik, pers. comm., 1987). The avifauna is rich in species. There is prime habitat for koklass pheasant *Pucrasia macrolopha* and monal pheasant *Lophophorus impejanus*, both of which are numerous (Wayre, 1971; T.J. Roberts, pers.

comm., 1986). The sanctuary is one of the few known breeding locations in Pakistan for white-bellied redstart *Hodgsonius phoenicuroides*. Long-legged buzzard *Buteo rufinus* and lammergeier *Gypaetus barbatus* also breed here (T.J. Roberts, pers. comm., 1986). Five species of fish occur in Kaghan Valley but their distribution within the sanctuary is not specified (Mirza and Hussain, 1985).

Cultural Heritage No information

Local Human Population There are no permanent settlements within the sanctuary but Gujars live lower down in the valley. These graziers spend the summer (June-July) in the sanctuary with their cattle, buffalo, goats and sheep (Wayre, 1971).

Visitors and Visitor Facilities There is a Forest Department rest house and youth hostel at Sharan.

Scientific Research and Facilities Parts of Manshi Forest Reserve were surveyed for pheasants in 1971 (Wayre, 1971).

Conservation Value This part of Manshi Forest Reserve was recommended as being the most suitable area in Kaghan Valley for protecting high-altitude-pheasants. The relative inaccessibility of the valley, coupled with the presence of snow during winter, facilitates protection of the sanctuary.

Conservation Management No information

Management Constraints The lower reaches of Kaghan Valley are the site of a West German-funded project to produce virus-free seed potatoes. A large area of forest has been cleared within the forest reserve and camps established for imported local labour, all of which are jeopardising the integrity of the sanctuary (T.J. Roberts, pers. comm., 1986). Grazing by domestic livestock is not controlled.

Staff No information

Budget No information

Local Addresses Range Officer, Balakot Range, NWFP Forest Department

References

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Date July 1986, updated August 1990

MARGALLA HILLS NATIONAL PARK

IUCN Management Category V (Protected Landscape)

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Comprises the hill ranges immediately to the north of the Federal Capital of Islamabad. 33°48'N, 73°10'E

Date and History of Establishment Declared a national park on 27 April 1980 under Section 21(1) of the Islamabad Wildlife (Protection, Conservation and Management) Ordinance, 1979. Prior to 1960, much of the area was reserved forest. Subsequently, it was declared a wildlife sanctuary under the West Pakistan Wildlife Protection Ordinance, 1959.

Area 17,386ha. The park comprises compartments 2-5, 7-23, 28, 30-38(i) and 41(ii) of Margalla Forest Reserve, compartments 1-25 of the Military Grass Farm and various other lands making a total area of 14,786ha, together with Rawal Lake and a surrounding buffer area of 2km from the high water mark. Rawal Lake is not contiguous with the rest of the park, the intervening area constituting part of Islamabad Game Reserve (69,800ha).

Land Tenure State (Federal Government). Land transferred to the Capital Development Authority in 1961, when Islamabad was declared the capital of Pakistan, includes 4,794ha of reserved forest, 3,315ha managed by the Military Farm Authorities and 3,636ha under private ownership (Masud, 1979).

Altitude Ranges between 456m and 1,580m.

Physical Features The topography is rugged, with numerous valleys and many steep and even precipitous slopes. The area is drained by the River Kurang and its tributaries, which flow into the River Soan. Rocks are Jurassic and Triassic in age, limestone being characteristic of the Margalla Range (though shales, clays and sandstones are also present). Soils are dark, with a high mineral content, and are capable of supporting good tree growth despite being shallow.

Climate Lying in the monsoon belt, the area experiences two rainy seasons. Winter rains last from January until March and summer rains from July until September. Based on climatic data from Rawalpindi for 1951 to 1965, mean annual rainfall is 951mm and mean monthly maximum and minimum temperatures range from 16.9°C to 40.1°C and from 3.1°C to 24.7°C, respectively (Masud, 1979).

Vegetation The two distinct types of vegetation are subtropical dry semi-evergreen forest and subtropical pine forest. The former is dominated by phulai *Acacia modesta* and kao *Olea ferruginea*, associated with sanatha *Dodonaea viscosa*, granda *Carissa spinarum* and ber *Zizyphus jujuba*, and having an undergrowth of bhekar *Justicia adhatoda*, gunger *Sageratia thea*, mullah *Zizyphus nummularia* and khokhal *Myrsine africana*. About 50 species of grass are present, the most common being dhauloo *Chrysopogon serrulatus*, palwan *Bothrichloa*

pertusa, *survala* *Heteropogon contortus*, *maniera* *Pennisetum orientale* and *loonder* *Themeda anthera*. Introduced ornamental tree species include: silver oak *Grevillea robusta*, *gulenishtar* *Erythrina suberosa*, *jacaranda* *Jacaranda mimosoefolia*, bottle brush *Callistemon viminalis*, *sakar* *Ehretia laevis*, *chir pine* *Pinus roxburghii*, *Cassia glauca*, *Porgania glabra* and *Eucalyptus* sp. Subtropical pine forest occurs above 1,000m, *chir pine* *Pinus roxburghii* being the characteristic canopy species with an undergrowth of *Myrsine africana*, *Woodfordia fruticosa*, *Berberis lycium* and *granda* *Carissa spinarum*. Forests are well-stocked on cooler aspects but those on the hotter southern slopes with poor soils are sparse and mixed with scrub.

Fauna Margalla Hills are unique in Pakistan, being rich in Sinohimalayan fauna, some species (especially birds) of which are at the western extremity of their distribution. Larger mammals are known to include rhesus macaque *Macaca mulatta*, leopard *Panthera pardus* (T), wild boar *Sus scrofa*, Indian muntjac *Munitacus muntjak* and goral *Nemorhaedus goral*. Noteworthy birds include white-eyed buzzard *Butastur teesa*, lannar falcon *Falco biarmicus*, black-shouldered kite *Elanus caeruleus*, *kalij* pheasant *Lophura leucomelana*, black partridge *Francolinus francolinus*, *sirkeer* cuckoo *Taccocua leschenaultii*, *jungle* nightjar *Caprimulgus indicus*, long-tailed nightjar *C. macrurus*, lesser golden-backed woodpecker *Dinopium benghalense* and lanceolated jay *Garrulus lanceolatus*. A list of mammals and birds believed to be found in the park is given in the master plan (Masud, 1979). Further details of the avifauna can be found in Corfield (1983). *Cheer* pheasant *Catreus wallichi* (E), reared at Dhok Jewan and Jabri, are being released into the park. The re-introduction programme is being carried out by the World Pheasant Association in collaboration with the Capital Development Authority (Howman, 1985; Anon., 1987).

Cultural Heritage There are a number of historical and religious sites but their importance needs to be evaluated. Shah Faisal Mosque lies outside the southern boundary of the park.

Local Human Population Shadarah is the only village remaining in the park; it is due to be relocated. Formerly, there were over a dozen villages inside the park, and the residents of Phulgran retained traditional rights to graze cattle in compartments 1 & 6 of Margalla Reserved Forest (Masud, 1979).

Visitors and Visitor Facilities Large numbers of residents from Islamabad and Rawalpindi, as well as foreigners, visit the park due to its proximity to the capital. There is a small zoo near the park entrance which will eventually be transferred to Islamabad Zoo and located in Islamabad Game Reserve. A visitor centre is planned for Daman-E-Koh, providing lounge accommodation and an information service. Lodges, camping grounds and picnic sites are also planned and the provision of a chair lift may be considered.

Scientific Research and Facilities The wildlife was surveyed in December 1977 by WWF in collaboration with the National Council for Conservation of Wildlife. The avifauna is well-documented (Corfield, 1983).

Conservation Value In its report of 1971, the Wildlife Enquiry Committee recommended that the park should be established in the interests of the people of Islamabad. It is also an extremely important watershed for the capital. With regard to its fauna, Margalla Hills is one of the richest areas for birds in Pakistan.

Conservation Management Margalla Hills has been managed by the Capital Development Authority since 1961 when it was declared a 'green' area. Reserved forests, *rakhs* (military grass

farms) and chaks (private holdings) have since been taken over by the Authority. Much of the original forest has been removed, even prior to the transferral of the forests to the Forest Department in the late 19th century (Elahi, 1970), but is gradually reverting to its original condition under the present management regime. The loss of grass habitat on southern slopes (former rakhs) is likely to be associated with the disappearance of cheer pheasant and the difficulties experienced in trying to re-introduce it (Young, 1986).

Objectives outlined in the master plan include restoring the vegetation and wildlife to its previous condition, stopping erosion, conserving the water supply and meeting the increased demand for outdoor recreation through the development of proper visitor facilities (Masud, 1979). A system of zonation, based on areas of varying intensities of visitor use, has been proposed to facilitate management. This includes a 3,100ha enclosure for captive breeding and re-introduction purposes, and wilderness areas (comprising 70% of the park area) in which development is permitted. It is proposed that the park be surrounded by a buffer zone of 8km, in which shooting is prohibited. An enclosure, with a 14km perimeter, is due to be sited in Dhoke Jewari Valley, as part of a plan to re-introduce muntjac and goral to the park.

Management Constraints Being adjacent to Islamabad, the park is subject to very high levels of use by visitors. Illegal grazing and collection of fuelwood are persistent problems. Large-scale planting of ornamental trees by the Horticultural Directorate detract from the integrity of the area (Masud, 1979).

Staff One deputy director, one assistant director, one veterinary officer, six range officers, 11 foresters, 43 forest guards, approximately 60 permanent labourers and an additional 120 casual labourers in April-June for fire-control work (1986)

Budget Recurrent expenditure (including upkeep of the zoo) of Rs 4.7 million is met by the Capital Development Authority; capital expenditure of Rs 2 million for the re-introduction of goral, chinkara, cheer pheasant and development of public amenities is met by this Authority and the National Council for Conservation of Wildlife in equal proportions (1986).

Local Addresses Deputy Director, Margalla Hills National Park, Capital Development Authority, Sitara Market, Islamabad

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Date July 1986, updated August 1990

NALTAR WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies close to Hunza Valley in northern Pakistan, 45km from the town of Gilgit. Approximately 36°07'N, 74°14'E

Date and History of Establishment Declared a wildlife sanctuary on 22 November 1975.

Area 27,206ha. Contiguous to Sher Qillah Game Reserve (16,842ha) and Pakora Game Reserve (7,515ha).

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 1,972m to 5,926m at Shanni Glacier.

Physical Features Naltar Valley lies at about 3,000m and is aligned in a north-west to south-east direction, with mountains on either side rising to about 5,800m (Winser and Winser, 1985). This fluvio-glacial valley follows the southern limbs of the Kailas Range for about 24km until its confluence with the Hunza River. The profile of the upper portion is glacial and typically 'U'-shaped, while that of the lower portion is 'V'-shaped due to river erosion. The meta-sedimentary and sedimentary sequence includes slates, quartzites, limestone and gneiss of pre-Carboniferous age. There are green stone, granodiorite and horn-blended granite intrusions. Igneous rocks are post Permo-Carboniferous in age. Late Cretaceous sediments overlay the green stone complex in Yasin Valley. The upper reaches of the Naltar River freeze during winter (Rasul, 1985).

Climate Annual rainfall ranges from 254mm to 381mm. Winter is severe (Rasul, 1985).

Vegetation The area falls within the dry temperate zone, but because of high rainfall supports luxuriant forests and ground cover (Rasul, 1985). Trees and shrubs include species of *Pistacia*, *Olea*, *Fraxinus*, *Sageratia*, *Eurotia*, *Juniperus*, *Picea*, *Betula*, *Salix* and *Populus*. Herbs include *Artemisia*, *Stipa* and *Haloxylon*.

Fauna Large mammals include markhor *Capra falconeri* (V), ibex *C. ibex*, snow leopard *Panthera uncia* (E), brown bear *Ursus arctos*, fox *Vulpes vulpes*, wolf *Canis lupus* (V), stone marten *Martes foina* and leopard cat *Felis bengalensis* (Rasul, 1985). Some 35 species of birds have been recorded (N. MacCallum, pers. comm.).

Cultural Heritage No information

Local Human Population There are a number of settlements in Naltar Valley, those higher up being used only in summer (Winser and Winser, 1985).

Visitors and Visitor Facilities No information

Scientific Research and Facilities An expedition from Aberdeen University carried out ecological studies on the pika *Ochotona roylei* and choughs *Pyrrhocorax* spp., and made collections of mosses, spiders and pseudo-scorpions (Winser and Winser, 1985).

Conservation Value Naltar is part of a protected areas complex which is important for a variety of threatened mammal species.

Conservation Management Wildlife is given complete protection. People residing within an 8km radius of the sanctuary enjoy concessions to extract timber and firewood, graze livestock and cut grass. A conservation management plan and plan for the establishment of a mini-zoo are being prepared (Rasul, 1985).

Management Constraints Include shortage of manpower, poaching and agricultural encroachment (Rasul, 1985).

Staff One game watcher (1985)

Budget Rs 10,000 p.a. (1985)

Local Addresses No information

References

- Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.
- Winser, N. and Winser, S. (Eds) (1985). *Expedition Yearbook 1984*. Expedition Advisory Centre, London. Pp. 111-112.

Date September 1988

NAR/GHORO NALLAH GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Baltistan District, about 26km by road from the town of Skardu. Approximately 35°06'N, 75°12'E

Date and History of Establishment Declared a game reserve on 22 November 1975.

Area 7,255ha

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 2,424m to 4,242m.

Physical Features The terrain is rugged and precipitous. Stream deposits of alluvium and gravel cover valley bottoms. Sedimentary, meta-sedimentary and igneous rocks are present (Rasul, 1985).

Climate Conditions are dry temperate. Annual precipitation is 76-102mm, with most falling as snow. Winters are severe and summers mild (Rasul, 1985).

Vegetation Trees and shrubs include *Juniperus*, *Betula*, *Salix* and *Fraxinus*. Ground flora consists of *Artemisia* and various grass species (Rasul, 1985).

Fauna Large mammals include ibex *Capra ibex*, musk deer *Moschus chrysogaster* (V) and snow leopard *Panthera uncia* (E). The larger birds include chukar *Alectoris chukar*, snow partridge *Lerwa lerwa*, snowcock *Tetraogallus* sp. and various raptor species (Rasul, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities None

Conservation Value No information

Conservation Management Wildlife is afforded full protection and the reserve is closed to hunting. Local people enjoy concessions to collect firewood, graze livestock and cut grass.

Management Constraints Include shortage of staff and poaching.

Staff One game watcher (1985)

Budget Rs 10,000 p.a. (1985)

Local Addresses No information

References

Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Date September 1988

NAZBAR NALLAH GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Yasin Tehsil of Gilgit District, 137km by bridle path from Gilgit Town. Approximately 36°22'N, 73°19'E

Date and History of Establishment Declared a game reserve on 22 November 1975.

Area 33,177ha. The reserve is contiguous to Chassi/Baushdar Game Reserve (37,053ha).

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 2,039m to 5,212m.

Physical Features The Nazbar catchment area includes numerous side nullahs with rugged, undulating topography.

Climate The climate is dry, with an annual precipitation of 127-254mm, most of which falls as snow. Winters are severe and summers mild (Rasul, 1985).

Vegetation Trees include *Juniperus* (sporadic and stunted), *Salix*, *Rosa*, *Fraxinus* and *Populus*. Ground flora includes *Artemisia*, *Stipa* and other grasses.

Fauna Large mammals include ibex *Capra ibex*, snow leopard *Panthera uncia* (E), lynx *Felis lynx* and fox *Vulpes vulpes*. Larger birds include chukar *Alectoris chukar*, snow partridge *Lerwa lerwa*, snowcock *Tetraogallus* sp. and various raptors and vultures (Rasul, 1985).

Cultural Heritage No information

Local Human Population Local inhabitants cultivate in the lower part of the reserve and graze livestock in the upper part (Rasul, 1985).

Visitors and Visitor Facilities No information

Scientific Research and Facilities None

Conservation Value No information

Conservation Management Wildlife is afforded full protection. Local inhabitants enjoy concessions to extract firewood and timber for domestic use, graze livestock and cut grass. There is no management plan (Rasul, 1985).

Management Constraints Include shortage of staff and poaching.

Staff One game watcher (1985)

Budget Rs 10,000 p.a. (1985)

Local Addresses No information

References

Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Date September 1988

NEMAL LAKE WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Lies 29 km east-north-east of Mianwali. 32°41'N, 71°49'E

Date and History of Establishment Declared a wildlife sanctuary in 1970, and re-notified in January 1979.

Area 486ha

Land Tenure The lake is state-owned (Provincial Government of the Punjab). Adjacent agricultural land is privately owned, and forested hill slopes and range lands are state-owned.

Altitude 352m

Physical Features Nermal is a shallow brackish lake, partly impounded by a dam in one corner, and fed by a small spring and several intermittent streams rising in the low hills of the Salt Range to the south-east. Maximum depth of the lake is 5.8m, and the mean 4.6m. The water level fluctuates widely, and is partially controlled by the removal of water for irrigation. The water is slightly saline (3.2 p.p.t. in 1964), and has a pH value of 7.3.

Climate Conditions are dry subtropical, with an annual rainfall of between 300mm and 600mm. Minimum temperatures in January range from 1°C to 5°C, and maximum temperatures in June from 40°C to 45°C.

Vegetation Aquatic vegetation consists of *Carex fedia*, *Hydrilla verticillata*, *Juncus* sp., *Phragmites karka*, *Potamogeton crispus*, *Saccharum spontaneum*, *Typha angustata* and *Zannichelliapalustris*. The natural vegetation of the region is a mixture of subtropical semi-evergreen scrub and tropical thorn scrub with species such as *Acacia modesta*, *A. nilotica*, *Adhatoda vasica*, *Dodonea viscosa*, *Gymnosporia royleana*, *Olea ferruginea*, *Prosopis cineraria*, *Reptonia buxifolia*, *Salvadora oleoides*, *Tamarix aphylla*, *T. dioica*, *Zizyphus mauritiana*, *Z. nummularia*, *Chrysopogon aucheri*, *Lasiurus hirsutus*, *Heteropogon contortus* and *Panicum antidotale*. *Prosopis glandulosa* has been introduced to the area. Most of the land adjacent to the lake has been cleared for agriculture.

Fauna The lake was an important wintering area for Anatidae, with between 2,000 and 5,000 birds present in mid-winter in the early 1970s. Smew *Mergus albeilus* and white-headed duck

Oxyura leucocephala (V) were regular winter visitors in small numbers, with maximum counts of 79 and 127 respectively. The number of birds visiting the lake has decreased, however, since the construction of Chashma Barrage on the Indus River. A flock of up to 50 greylag goose *Anser anser* continues to winter in the area, along with small numbers of a wide variety of other waterfowl. Further details are given in Scott (1989).

Mammals known to occur in the area include jackal *Canis aureus*, fox *Vulpes vulpes* and black-naped hare *Lepus nigricollis*. Fishes include *Catla catla*, *Channa marulius*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Salmo faria*, *Tilapia mossambica* and *Labeo rohita*.

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities Sulphur springs along the irrigation canal attract visitors seeking medicinal treatment.

Scientific Research and Facilities Mid-winter waterfowl counts have been carried out since 1971.

Conservation Value The lake supports a variety of waterfowl but is no longer important as a wintering area for ducks. It supports a commercial fishery and provides opportunities for outdoor recreation, as well as being important for irrigation.

Conservation Management Protection of the sanctuary has improved considerably since its re-notification. Fishing is permitted under licence from the Punjab Fisheries Department. The Department has recently developed a project to improve stocks of commercially important species. Livestock are grazed on the surrounding range land, and some leases have been granted to mine in the nearby hills.

Management Constraints Fishing, grazing and agricultural activities around the lake cause some disturbance to waterfowl. The wide fluctuations in water level and changes in salinity may be having a detrimental effect on the habitat. There is some illegal hunting.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

PAKORA GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Gilgit District, 97km by road from the town of Gilgit. The reserve is located in Ishkuman, 47km from Gakuch Punial. Approximately 36°24'N, 73°53'E

Date and History of Establishment Declared a game reserve on 22 November 1975.

Area 7,515ha. The reserve is contiguous to Naltar Wildlife Sanctuary (27,206ha).

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 2,333m to 4,848m.

Physical Features Pakora Nullah is very narrow at its mouth, which is flanked by steep slopes. Higher up it opens out, giving way to gentle slopes. Schist, quartzite and limestone are present in sedimentary, meta-sedimentary and igneous rocks (Rasul, 1985).

Climate Conditions are dry temperate. Annual precipitation ranges from 127mm to 254mm, most of which is in the form of snow. Winters are severe and summers cool (Rasul, 1985).

Vegetation Trees and shrubs include *Juniperus*, *Fraxinus*, *Olea* and *Rosa*. *Artemisia*, *Stipa* and other grasses are present (Rasul, 1985).

Fauna Large mammals include ibex *Capra ibex*, snow leopard *Panthera uncia* (E), wolf *Canis lupus* (V) and fox *Vulpes vulpes*. Larger birds include chukar *Alectoris chukar*, snow partridge *Lerwa lerwa*, snowcock *Tetraogallus* sp. and various raptors and vultures (Rasul, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities None

Conservation Value The reserve is part of a protected areas complex which is important for a variety of threatened mammal species.

Conservation Management Wildlife is afforded full protection. Local inhabitants enjoy concessions to extract firewood and timber and graze livestock. The reserve is completely closed for hunting. No management plan exists.

Management Constraints Include shortage of manpower and poaching.

Staff One game watcher (1985)

Budget Rs 10,000 p.a. (1985)

Local Addresses No information

References

Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Date September 1988

RASOOL BARRAGE WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Situated on the Jhelum River, 30km downstream from Jhelum and 52km west-north-west of Gujrat. The reservoir abuts the Salt Range to the north-west and cultivated plains to the south-east. 32°43'N, 73°33'E

Date and History of Establishment Declared a wildlife sanctuary in 1974. It was re-notified in September 1984.

Area 1,138ha

Land Tenure The reservoir is state owned (Provincial Government of the Punjab). The hills to the north-west are state-owned, and agricultural land to the south-east is privately owned.

Altitude 190m

Physical Features Comprises a water storage reservoir with associated marshes and extensive sand banks, created by the damming of the Jhelum River for irrigation purposes. Shallow lagoons are maintained by two embankments, which hold back the water as the level of the main channel falls. The water level fluctuates by about 2m, its maximum depth is 6.5m. The pH value varies between 6.8 and 7.2.

Climate Conditions are subtropical monsoonal, with hot summers and cool winters. Annual rainfall varies from 200mm to 500mm. Mean minimum temperature in January is 5.5°C, and mean maximum in June 40°C.

Vegetation Aquatic vegetation includes *Carex fedia*, *Hydrilla verticillata*, *Nelumbo nucifera*, *Nymphaea lotus*, *Phragmites karka*, *Potamogeton crispus*, *P. pectinatus*, *Typha angustata*,

Vallisneria spiralis and *Zannichellia palustris*. The hills of the Salt Range to the north-west support subtropical semi-evergreen forest dominated by *Olea ferruginea*, *Acacia modesta* and *Dodonea viscosa*. The natural vegetation of the plains to the south-east is tropical thorn forest with species such as *Acacia nilotica*, *Capparis decidua*, *Prosopis cineraria*, *Tamarix aphylla*, *Zizyphus mauritiana*, *Z. nummularia*, *Calotropis procera*, *Eleusine compressa*, *Erianthus* sp., *Panicum antidotale* and *Saccharum* spp. *Dalbergia sissoo* and *Acacia nilotica* have been extensively planted alongside roads and agricultural land.

Fauna Mid-January waterfowl censuses in 1987 and 1988 produced totals of 52,400 and 43,000, respectively, of which the most numerous species were: wigeon *Anas penelope* (nearly 1,000), teal *A. crecca* (12,375), pintail *Anas acuta* (15,050), pochard *Aythya ferina* (8,480), and coot *Fulica atra* (18,000). Further details of the waterfowl are given by Scott (1989).

Mammals known to occur in the area include wild boar *Sus scrofa*, jackal *Canis aureus* and jungle cat *Felis chaus*. Hog deer *Axis porcinus* is believed to have been extirpated from the region.

The rich fish fauna includes *Notopterus notopterus*, *Labeo rohita*, *L. gonius*, *L. microphthalmus*, *Barilius vagra*, *B. chilwa*, *Cirrhinus mrigala*, *Tor tor*, *Puntius ticto*, *Catla catla*, *Channa marulius*, *Cyprinus carpio*, *Salmo faria*, *Eutropiichthys vacha*, *Mystus bleekeri*, *M. seenghala*, *Macrognathus aculeatus*, *Mastacembelus pancalus*, *Bagarius bagarius*, *Sisor rabdophorus*, *Gagata cenia* and *Sicamugil cascasia*. Other aquatic fauna includes *Hirudinaria* sp., *Palaemon dayanus*, *P. lammarrei*, *Rana tigrina*, *Kachuga smithi* and *Lissemys punctata*.

Cultural Heritage No information

Local Human Population Fishing is permitted under licence, and reeds and rushes are harvested for local cottage industries. Adjacent areas are used for cattle grazing, forestry and agriculture.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Mid-winter waterfowl counts have been carried out regularly since 1974.

Conservation Value The shallow lagoons provide excellent wintering habitat for large numbers of waterfowl, mainly Anatidae. The reservoir is important for flood control and as a source of water for irrigation. It supports an important fishery, and has considerable potential for scientific research and education.

Conservation Management The reservoir is under the control of the Irrigation Department. Since the re-notification of the sanctuary in 1984, the level of protection has improved. Stringent measures are now being taken to manage the area.

Management Constraints Fishing activities cause some disturbance to waterfowl. There are occasional incidences of illegal hunting.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

SATPARA WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Baltistan District, 3km from the town of Skardu. Approximately 35°12'N, 75°07'E

Date and History of Establishment Declared a wildlife sanctuary on 22 November 1975.

Area 31,093ha

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 2,691m to 4,242m.

Physical Features The site consists of the catchment area of Satpara Nullah and lake, and borders on the Deosai Plains. The terrain is rugged with scree slopes. Sedimentary and meta-sedimentary rocks with schist and quartzite, as well as various types of igneous rocks, are found in the area. Stream deposits of alluvium and gravel occur in valley bottoms (Rasul, 1985).

Climate Conditions are dry temperate. Annual precipitation is 76-102mm, most of which falls as snow in December and January. Winters are dry and severe, while summers are mild (Rasul, 1985).

Vegetation Comprises stunted juniper *Juniperus*, birch *Betula* and *Rosa*. (Rasul, 1985).

Fauna Large mammals include ibex *Capra ibex*, musk deer *Moschus chrysogaster* (V) and urial *Ovis vignei*. Larger birds include chukar *Alectoris chukar*, snowcock *Tetraogallus* sp., and a variety of raptors and vultures.

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities None

Conservation Value The site was originally proposed as part of a much larger national park, on account of its spectacular scenery and large mammal populations (Mountfort and Poore, 1968).

Conservation Management Wildlife is afforded full protection. Local people enjoy concessions to collect fallen dead wood for fuel and graze livestock. No management plan exists for the area (Rasul, 1985).

Management Constraints Include shortage of manpower.

Staff One game watcher under the control of a Forest Range Officer (1985)

Budget Rs 10,000 p.a. (1985)

Local Addresses Forest Range Officer, Wildlife Headquarters, Skardu

References

Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Mountfort, G. and Poore, D. (1968). Report on the Second World Wildlife Fund Expedition to Pakistan. World Wildlife Fund, Morges, Switzerland. Unpublished report. 25 pp.

Date September 1988

SHER QILLAH GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Ghizer Forest Division about 48km from the town of Gilgit. Approximately 36°24'N, 73°53'E

Date and History of Establishment Declared a game reserve on 22 November 1975.

Area 16,842ha. The reserve is contiguous to Nalter Wildlife Sanctuary (27,206ha).

Land Tenure State (Administration of Northern Areas)

Altitude Ranges from 1,983m to 5,818m.

Physical Features The terrain is rugged and mountainous. Sedimentary, meta-sedimentary and a sequence of quartzite, slate and limestone rocks are present, all with intrusions of granodiorite and horn-blended granite of Tertiary age (Rasul, 1985).

Climate Conditions are dry temperate. Annual precipitation varies from 254mm to 381mm, most of which falls as snow during the severe winter.

Vegetation Trees and shrubs include kail, *Picea*, *Juniperus*, *Betula*, *Salix*, *Fraxinus* and *Olea*. Herbs include *Haloxylon*, *Artemisia* and *Stipa* (Rasul, 1985).

Fauna Large mammals include markhor *Capra falconeri* (V), ibex *C. ibex*, snow leopard *Panthera uncia* (E), brown bear *Ursus arctos*, lynx *Felis lynx* and fox *Vulpes vulpes*. Larger birds include chukar *Alectoris chukar*, snow partridge *Lerwa lerwa*, snowcock *Tetraogallus* sp. and a variety of raptors and vultures (Rasul, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities None

Conservation Value The reserve falls within a protected areas complex which is important for a variety of threatened mammal species.

Conservation Management Wildlife is afforded complete protection and the area is closed to hunting. Local people enjoy concessions to collect firewood and timber for domestic use and for livestock grazing. No management plan exists at present.

Management Constraints Include shortage of manpower and poaching.

Staff One game watcher (1985)

Budget Rs 10,000 p.a. (1985)

Local Addresses No information

References

Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Date September 1988

TANDA DAM

IUCN Management Category Unassigned

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Lies east of Barh Village, 7km west of Kohat. The wetland is bounded by the cultivated areas of Shahpur to the south and Bai to the west. 33°35'N, 71°22'E

Date and History of Establishment Designated as a Wetland of International Importance at the time of Pakistan's ratification of the Ramsar Convention on 23 July 1976.

Area 405ha. According to Scott (1989) the area of the dam is 644ha.

Land Tenure State (Government of North-West Frontier Province)

Altitude 528m

Physical Features Tanda is a small freshwater reservoir which lies in a shallow valley surrounded by hills rising to 700m. The reservoir is fed by the Kohat Toi and local run-off. Mud banks are exposed at low water levels. Mean depth is about 30.5m, the water level fluctuating according to local rainfall and flooding of the Kohat Toi. The pH value is 6.5.

Climate Conditions are dry subtropical, with an annual rainfall of 250-760mm (average 300mm). Temperatures range from 0°C to 20°C in winter, and from 24°C to 45°C in summer.

Vegetation There is very little submerged vegetation and there are no large areas of marsh vegetation. Aquatic vegetation consists of *Cyperus* sp., *Phyla nodiflora*, *Polygonum plebejum*, *P. glabrum*, *Pulicaria crispa* and *Typha angustata*. The natural vegetation of the region is tropical thorn forest intergrading with dry subtropical broad-leaved forest. Dominant species include *Acacia modesta*, *Dodonea viscosa*, *Adhatoda vasica*, *Withania coagulans*, *Sageretia theezans*, *Rhazya stricta*, *Zizyphus nummularia* and *Z. mauritiana*. *Parkinsonia aculeata*, *Prosopis glandulosa* and *Tamarix dioica* have become naturalised in the area. Much of the natural vegetation around the reservoir has been cleared for agriculture.

Fauna The reservoir is a wintering area for small numbers of migratory waterfowl, notably black-necked grebe *Podiceps nigricollis*, great crested grebe *P. cristatus*, great egret *Egretta alba*, grey heron *Ardea cinerea*, shelduck *Tadorna ferruginea*, teal *Anas crecca* (up to 180), mallard *A. platyrhynchos* (up to 780), pintail *A. acuta*, pochard *Aythya ferina* (up to 180), tufted duck *A. fuligula* and black-winged stilt *Himantopus himantopus*. Other birds recorded in the area include black partridge *Francolinus francolinus*, Indian grey francolin *F. pondicerianus* and white-breasted kingfisher *Halcyon smyrnensis*.

Mammals include jackal *Canis aureus*, wolf *C. lupus* (V), fox *Vulpes bengalensis* and black-naped hare *Lepus nigricollis*.

Fishes include *Catla catla*, *Cirrhinus mrigala*, *Channa marulius*, *Cyprinion* sp., *Cyprinus carpio*, *Labeo rohita*, *Salmo faria*, *Tilapia mossambica* and *Tor tor*.

Cultural Heritage No information

Local Human Population Activities include fishing, recreation and harvesting of reeds (*Typha*) for a small cottage industry. Livestock graze the marshes, and the surrounding area is cultivated.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Mid-winter waterfowl counts were carried out by the Pakistan Forest Institute from 1978 to 1981, and have been undertaken annually since then by the Zoological Survey Department. Regular censuses need to be carried out during the migration seasons because the wetland may be more important as a staging than a wintering area for waterfowl.

Conservation Value Tanda Dam is an important wintering and staging area for waterfowl. The reservoir provides a source of water for irrigation, and serves a valuable function in flood control. It supports a small fishery, and provides opportunities for outdoor recreation.

Conservation Management Administration and management of the wetland is the responsibility of the provincial Wildlife Department. A four-year project for the afforestation of the water catchment area was initiated in 1984, and a reserved forest area of 162ha has been established in the adjacent hills. The area has been proposed as a wildlife sanctuary. The Fisheries Department has established a fish hatchery at the reservoir. Despite stocking, fish production is low because of the paucity of aquatic vegetation.

Management Constraints Fishermen are a constant source of disturbance to the waterfowl, and disturbance from recreational activities could become a problem in the future. Livestock grazing and the cutting of reeds are excessive.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

TANGIR GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 2.38.12 (Himalayan Highlands)

Geographical Location Lies in Diamer District on the boundary with Swat, some 113km and 274km from the towns of Chilas and Gilgit, respectively. It is accessible only by foot. Approximately 35°36'N, 73°24'E

Date and History of Establishment Declared a game reserve on 22 November 1975.

Area 14,251ha

Land Tenure State (Administration of Northern Areas). Some land is privately owned.

Altitude Ranges from 1,515m to 4,545m.

Physical Features Terrain is mostly mountainous with rugged, steep slopes. Rocks are igneous, sedimentary and meta-sedimentary, with schist, quartzite and limestone deposits.

Climate Annual rainfall ranges from 254mm to 381mm. Snow falls during the severe winter months of November and December, and light showers are characteristic of the summer monsoon season. Summers are mild (Rasul, 1985).

Vegetation Trees and shrubs include *Olea*, *Quercus*, *Pistacia*, *Lonicera*, *Salix*, *Betula*, *Juniperus*, *Pinus gerardiana*, *Deodar* and *Rosa*. Ground flora comprises *Ferula*, *Artemisia*, *Stipa* and other herbs.

Fauna Large mammals include markhor *Capra falconeri* (V), snow leopard *Panthera uncia* (E), Himalayan black bear *Selenarctos thibetanus*, fox *Vulpes vulpes*, wolf *Canis lupus* (V) and lynx *Felis lynx*. Of the avifauna, there are a variety of pheasants, including chukar *Alectoris chukar*, snow partridge *Lerwa lerwa*, snowcock *Tetraogallus* sp. and monal pheasant *Lophophorus impejanus* (Rasul, 1985).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities None

Conservation Value The reserve supports a variety of threatened mammal species.

Conservation Management Wildlife is afforded full protection. Hunting is banned. Local inhabitants enjoy concessions to graze livestock, cut grass and collect firewood and timber for domestic use. There is no management plan (Rasul, 1985).

Management Constraints Include shortage of staff and poaching.

Staff One game watcher (1985)

Budget Rs 10,000 p.a. (1985)

Local Addresses No information

References

Rasul, G. (1985). *National parks and equivalent reserves in northern areas of Pakistan*. Wildlife Division, Northern Areas, Forest Department, Gilgit. 36 pp.

Date September 1988

TAUNSA BARRAGE WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.15.07 (Thar Desert)

Geographical Location Lies behind a barrage on the Indus River near the town of Taunsa, 20km north-west of Kot Adu, Muzaffargarh District. 30°42'N, 70°50'E

Date and History of Establishment Declared a wildlife sanctuary in 1972 and re-notified in April 1983.

Area 6,567ha

Land Tenure State (Provincial Government of the Punjab)

Altitude 139m

Physical Features Taunsa Barrage was constructed for irrigation purposes. Five embankments project into the reservoir and retain shallow lagoons as the water level in the main river channel recedes. The depth of water in the main channel varies from 5.0m to 11.5m, depending on flood levels; in the seepage lagoons it varies from 0.2m to 5.0m. The pH value is 6.5-7.0.

Climate Conditions are dry subtropical, with an annual rainfall of 200-450mm. Mean minimum temperature in January is 4.5-5.5°C, and mean maximum in June is 42.0-45.0°C.

Vegetation The aquatic vegetation in the seepage lagoons includes *Carex fedia*, *Hydrilla verticillata*, *Nelumbium speciosum*, *Nymphaea lotus*, *Phragmites karka*, *Potamogeton crispus*,

P. pectinatus, *Ranunculus aquatilis*, *Saccharum spontaneum*, *Typha angustata*, *Vallisneria spiralis* and *Zannichellia palustris*. Much of the land adjacent to the reservoir is cultivated, mainly for cotton, sugar cane, wheat and fodder crops. Riverine forest along the Indus is dominated by *Dalbergia sissoo* and *Populus euphratica*, in association with *Tamarix dioica*. Other natural vegetation includes *Acacia nilotica*, *Prosopis cineraria*, *Pisum arvense*, *Salsola barysoma*, *Cynodon dactylon*, *Eleusine compressa* and *Panicum antidotale*.

Fauna Up to 430 bar-headed goose *Anser indicus* were recorded in the early 1970s, but numbers have shown a serious decline in recent years. Lesser whistling duck *Dendrocygna javanica* is a common breeding summer visitor. The rare marbled teal *Marmaronetta angustirostris* is a regular passage migrant and winter visitor in small numbers. Over 24,000 waterfowl were present in mid-January 1987, the most numerous species including: Eurasian wigeon *Anas penelope* (2,780), common teal *A. crecca* (4,880), northern pintail *A. acuta* (1,660), common pochard *Aythya ferina* (4,690), common coot *Fulica atra* (7,510). Further details of the waterfowl are given in Scott (1989).

Mammals include small numbers of Indus dolphin *Platanista indi* (E), smooth-coated otter *Lutra perspicillata* and hog deer *Axis porcinus*. Other mammals include jackal *Canis aureus*, jungle cat *Felis chaus*, wild boar *Sus scrofa* and black-naped hare *Lepus nigricollis*. Reptiles include gharial *Gavialis gangeticus* (E), two adults having been reported at the barrage in about 1980.

Fish species known to inhabit the river and lagoons include *Ambassis nama*, *A. ranga*, *Bagarius bagarius*, *Barilius vagra*, *Catla catla*, *Channa marulius*, *C. punctatus*, *Cirrhinus mrigala*, *C. reba*, *Eutropiichthys vacha*, *Heteropneustes fossilis*, *Labeo calbasu*, *L. microphthalmus*, *L. rohita*, *Mastacembelus armatus*, *M. pancalus*, *Mystus aor*, *M. seenghala*, *Nandus nandus*, *Notopterus chitale*, *N. notopterus*, *Puntius sophore*, *P. ticto*, *Rita rita* and *Wallago attu*. Other aquatic fauna includes *Hirudinaria* sp., *Rana tigrina*, *Kachuga smithi*, *Hardella thurgi*, *Geoclemys hamiltonii*, *Trionyx gangeticus*, *Lissemys punctata* and *Natrix piscator*.

Cultural Heritage No information

Local Human Population Land exposed at low water levels is leased to local farmers for cultivation during the dry season. The reservoir is used for fishing and recreation, and its reeds are harvested. Surrounding land is cultivated, grazed and used for forestry.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Mid-winter waterfowl censuses have been carried out regularly since 1973. The Punjab Fisheries Department has conducted research on the fishery resources, and a joint project on the Indus dolphin is being developed by the Punjab Wildlife Department and the Zoological Survey Department. A study of migrant cranes is due to commence shortly.

Conservation Value The wetland is a very important wintering area for waterfowl, notably Anatidae, a breeding area for several species, particularly lesser whistling duck, and a staging area for cranes (*Grus grus* and *Anthropoides virgo*) and shorebirds. It is also the most important wintering area in Pakistan for bar-headed goose and an important refuge for Indus dolphin. The reservoir supplies water for irrigation, and supports a fishery worth more than one million rupees

per year. It also provides excellent opportunities for scientific research and conservation education.

Conservation Management No management plan exists. The Punjab Wildlife Department plans to erect nest-boxes for lesser whistling duck.

Management Constraints The main threat to the wetland at present is the occasional burning of vegetation in the seepage lagoons. Fishing activities and illegal hunting by local people cause some disturbance, and there have been reports of waterfowl drowning in fishing nets. There is a proposal to construct a new flood barrage further upstream on the Indus, and this could result in reduced water levels at Taunsa Barrage.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

THANADARWALA GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 4.08.04 (Indus-Ganges Monsoon Forest)

Geographical Location Lies at the junction of Gambilla and Kurram rivers, 15km east of Lakki in Bannu District. 32°37'N, 71°05'E.

Date and History of Establishment Thanadarwala was declared a game reserve in 1976, and subsequently designated a Wetland of International Importance at the time of Pakistan's ratification of the Ramsar Convention on 23 July 1976.

Area 4,047ha

Land Tenure The wetland is under communal ownership; surrounding areas are owned by local villagers.

Altitude 303m

Physical Features Thanadarwala comprises a shallow, fresh to brackish seepage lagoon and an extensive marshy area. The depth of water fluctuates from 0.1m to 1.5m according to the

supply of flood water from the two rivers, their levels rising in March and again in July-September. The pH value is 9.0. Surrounding areas are mostly saline.

Climate Conditions are dry subtropical, with a mean annual rainfall of 250mm. Temperatures range from 4°C to 18°C in winter and from 25°C to 47°C in summer.

Vegetation The marsh vegetation includes *Tamarix dioica*, *Typha angustata*, *Phragmites karka*, *Cyperus laevigatus*, *Kochia indica*, *Desmostachya bipinnata*, *Imperata cylindrica* and species of *Chara*, *Launaea*, *Phoenix*, *Potamogeton*, *Ranunculus* and *Saccharum*. Much of the surrounding area is cultivated for wheat and other crops. The natural vegetation of the region is tropical thorn forest, with dominant species including *Prosopis cineraria*, *Tamarix aphylla*, *Zizyphus nummularia*, *Calligonum polygonoides*, *Rhazya stricta*, *Aerua javanica*, *Chenopodium album*, *Cassia obovata*, *Heliotropium* sp., *Tribulus terrestris*, *Asphodelus tenuifolius*, *Cenchrus ciliaris* and *Dactyloctenium scindicum*.

Fauna The reserve is a wintering area for great egret *Egretta alba* and Anatidae, notably shelduck *Tadorna ferruginea*, teal *Anas crecca*, mallard *A. platyrhynchos*, shoveler *A. clypeata*, pochard *Aythya ferina* and ferruginous duck *A. nyroca*. Waterfowl recorded during the mid-January censuses in 1987 and 1988 included up to 600 shorebirds of eight species and small numbers of three species of Ardeidae, white stork *Ciconia ciconia*, three species of Anatidae and purple swamphen *Porphyrio porphyrio*. Other fauna includes agamid *Uromastix* sp. and common monitor *Varanus bengalensis*.

Cultural Heritage No information

Local Human Population Activities include cutting of *Typha* and *Saccharum* for a local cottage industry, and hunting (shooting and trapping) of waterfowl. Surrounding areas are cultivated and grazed by livestock.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Mid-winter waterfowl counts were carried out by the Pakistan Forest Institute in 1979-1981, and have been undertaken annually since then by the Zoological Survey Department.

Conservation Value Thanadarwala is important for waterfowl and under proper management could become important for fish conservation.

Conservation Management Information about the management of the property is not available. Proposals have been made for the reclamation of saline soils for agriculture, and for the afforestation of saline and water-logged areas. There are also plans for a watershed management project to control erosion and reduce siltation.

Management Constraints Include hunting, cutting of aquatic vegetation and excessive grazing by domestic livestock (goats, sheep, cattle and camels). Salinity levels are increasing, and there is a possibility that the wetland will be drained if public pressure for the reclamation of land continues to increase.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date August 1990

ZANGI NAWAR GAME RESERVE

IUCN Management Category Unassigned

Biogeographical Province 2.20.08 (Anatolian-Iranian Desert)

Geographical Location Lies 48km west-south-west of Nushki in Chaghi District, northern central Baluchistan Province. 29°27'N, 65°47'E

Date and History of Establishment Declared a game reserve in 1982.

Area 1,060ha

Land Tenure State (Provincial Government of Baluchistan)

Altitude 975m

Physical Features Zangi Nawar is a brackish wetland which lies in a desolate region of stony peneplain alternating with low ridges of sedimentary rocks. The lake comprises a chain of lagoons extending some 12.8km along an east-west axis. It is surrounded on all sides by high, windblown sand dunes and fed by the Bohr Lora, which drains the hills to the north-east. The surface area and depth of the lake fluctuate widely according to rainfall. After heavy rains the lake covers some 2,070ha at a mean depth of 1.07m, while in the summer months it shrinks to some 770ha at a mean depth of 0.9m. The water is saline, with a pH of 9.2 and dissolved solids of mostly bicarbonates (Roberts, 1984, 1985).

Climate Conditions are arid subtropical, with a mean annual rainfall of 76mm at Nushki. There is no monsoon influence nor any season of reliable rainfall but showers usually occur in winter and spring. Mean temperatures in the hottest months of June and July are around 39.6°C, reaching a maximum of 42°C, and in January and February are 3.3°C, falling at night to as low as -4°C (Roberts, 1984, 1985).

Vegetation The shores are fringed with a deciduous tamarisk *Tamarix articulata*, while the numerous lagoons and islets are covered by reedbeds of *Phragmites karka*, the dominant emergent vegetation in the lake, and stands of reedmace *Typha angustifolia*. The lake is eutrophic; its bottom is carpeted with green algae and the aquatic weed *Ruppia maritima*, along

with smaller patches of *Potamogeton pectinatus*, forms a mat on the surface. Sand dunes surrounding the lake support thinly scattered clumps of the xerophytic grass *Eleusine compressa* and stunted bushes of the woody *Calligonum polygonoides* (Roberts, 1984, 1985).

Fauna Zangi Nawar is the only known wetland in the Indian sub-continent visited by whooper swan *Cygnus cygnus* in recent decades. It is the breeding home of probably the major population of marbled teal *Marmaronetta angustirostris* (over 250 in 1984) within the region, including adjacent Afghanistan and Iran, and is the only known breeding locality for white-tailed lapwing *Vanellus leucurus* (25). Large numbers of little grebe *Tachybaptus ruficollis* (4,000), coot *Fulica atra* (2,000) and moorhen *Gallinula chloropus* (4,500) also breed at the lake. The number of birds occurring on the lake during autumn and spring passage is more than double the mid-winter estimate of 22,000 duck and 66,000 coot. Other notable species recorded include: peregrine falcon *Falco peregrinus* (V), marsh harrier *Circus aeruginosus* (over 50) and white-eyed pochard *Aythya nyroca* (over 30). Roberts (1984, 1985) lists both visiting and breeding species recorded during his 1984 visit.

Mammals present in the vicinity of the lake include: jackal *Canis aureus*, brush-footed jerboas *Jaculus blandfordi* and desert pipistrelle *Pipistrellus kuhli*. Reptiles include Central Asian monitor *Varanus griseus caspius*(V), yellow-speckled toad agama *Phrynocephalus luteoguttatus*(V), Turkestan plate-tailed gecko *Teratoscincus scincus*, reticulate desert lacerta *Eremias acuti-rostris* and leaf-nosed viper *Eristicophis macmahoni* (Roberts, 1984, 1985).

Cultural Heritage No information

Local Human Population The immediate area surrounding the lake is uninhabited except for a few Afghan refugee camps along the western shore.

Visitors and Visitor Facilities None

Scientific Research and Facilities Avifaunal surveys have been carried out by Christison (1941) and Roberts (1984, 1985).

Conservation Value Zangi Nawar is a wildfowl refuge of international importance. It is a vital staging area for migrant waterfowl, as well as an important breeding area for a host of unusual Palaearctic birds and an impressive number of Palaearctic wintering visitors, due to its rich and diverse planktonic and micro-crustacean fauna and the absence of alternative wetlands within a radius of at least 300km (Roberts, 1984, 1985). It has been recommended that the reserve be designated a Wetland of International Importance under the Ramsar Convention (Scott, 1989).

Conservation Management A management plan has yet to be prepared. Protection is reported to be ineffective. Staff are few and poorly equipped, lacking transport facilities and equipment. Plans are being developed to provide a permanent water supply for the lake to maintain the wetland habitat (Scott, 1989).

Management Constraints The wetland can dry up almost completely during periods of prolonged drought, as in January 1985 when it shrunk from about 1,000ha to just over 5ha. At such times, birds become concentrated and are particularly vulnerable to poaching (Ahmad, 1986). Roberts (1984, 1985) found ample evidence of illegal shooting on islets in the lake, while

in February 1985 Ahmad (1985) observed that duck were virtually absent from the lake due to high hunting pressure. Settlements have been established on the western borders of the lake, and water from the stream feeding the lake is now being used for domestic consumption and for irrigation (Scott, 1989).

Staff Four game watchers (1984)

Budget No information

Local Addresses Chief Conservator of Forests, Department of Forestry, Nushki, Chaghi District

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Date July 1986, updated August 1989

ZIARAT JUNIPER WILDLIFE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 2.20.08 (Anatolian-Iranian Desert)

Geographical Location Lies in the vicinity of Ziarat, Sibi District, some 90 km east-north-east of Quetta. Approximately 30°24'N, 67°44'E

Date and History of Establishment Declared a wildlife sanctuary in 1971. Originally afforded some protection as reserved forest.

Area 37,247ha

Land Tenure State (Provincial Government of Baluchistan)

Altitude Ranges from about 2,000m to 3,487m (Khalifat)

Physical Features The tract is mountainous. In general, soils are shallow and poor, derived from Siwalik conglomerates, sandstones and shales. They comprise calcareous clay-loams overlying mainly soft shale (Khan, 1977; Khan, 1980).

Climate Conditions are of the dry Mediterranean type, with an annual rainfall of 250-350mm, depending on altitude. Mean maximum and minimum temperatures, respectively, are highest in July/August (c. 27°C) and lowest in January (c. 1°C). Winds are predominantly northerly and average 132km per hour (Khan, 1977; Khan, 1980).

Vegetation Mountain valleys and slopes at 2,200m support pure stands of *Juniperus macro-poda* (*excelsa*), with specimens up to 1.5m in girth at the base and many known to be over 2,500 years old (Hafizullah Khan, cited in Roberts, 1986). In the more sheltered ravines or on moister northern slopes, there is some admixture of *Fraxinus xanthoxyloides* and *Pistacia cabulica*, while the more conspicuous shrubs scattered among the junipers are almond *Prunus eburnea*, *Berberis baluchistani*, *Lonicera hypoleuca*, *Rosa beggeriana*, *Buddleia crispa* and *Cotoneaster pruinosa* (Stewart, 1982). A conspicuous feature of the landscape are the numerous spiny hassock-shaped plants, such as *Astragalus* spp., *Onobrychis* spp. and *Acantholimon* spp. Spring is marked by a variety of bulbs colouring the landscape, with *Ferula oopoda*, foxtail lily *Eremurus stenophylla*, *Iris* spp., *Allium* spp. and *Tulipa* spp. (Roberts, 1986). Details of the plant communities are given by Khan (1980).

Fauna The area has no endemic vertebrate species but has acted as a corridor for southwards invasion of Sino-Himalayan species able to cope with the harsh dry climate. Himalayan black bear *Selenarctos thibetanus* and markhor *Capra falconeri* (V) both occur as distinctive subspecies, as well as such birds as streaked laughing thrush *Garrulax lineatus*, Simla black tit *Parus rufonuchalis* and bar-tailed tree creeper *Certhia himalayana*. Little known Central Asian species include Pallas's cat *Felis manul*, of which an erythristic form is frequent, marbled polecat *Vormela peregusna* and Afghan pika *Ochotona rufescens*. There are many representatives of the western Palaearctic fauna with restricted distributions, including forest dormouse *Dryomys nitedula*, migratory hamster *Cricetulus migratorius* and breeding birds such as black redstart *Phoenicurus ochruros* and red-billed chough *Pyrrhocorax pyrrhocorax*. Other breeding birds include white-winged grosbeak *Mycerobas carnipes*, olivaceous leaf warbler *Phylloscopus griseolus*, plain leaf warbler *P. neglectus* and white-cheeked tit *Aegithalos leucogenys*. Reptiles include Persian horned viper *Pseudocerastes persicus* and Caucasian rock agama lizard *Aegithalos caucasia* (Roberts, 1986).

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities Studies of the juniper forests include those of Repp and Khan (1960), Khattak (1963), Ali (1966) and Repp and Beg (1966). Other research includes surveys of the vegetation of Khalifat in 1977 to identify good markhor habitat (Khan, 1980), and of a 27-year old exclosure at Bastargi (Khan, 1977).

Conservation Value The juniper forests of north central Baluchistan are identified as one of three critical ecosystems of international importance in Pakistan (Roberts, 1986). They are believed to have been the most extensive in the world (A.S. Swathi, cited in Roberts, 1986) and, according to the *Baluchistan Gazetteer* of 1908, covered 29,267ha of reserved forests at the beginning of this century. These forests support an unique flora and fauna, having a combination of Sino-Himalayan elements as well as Central Asian and Irano-Turanian affinities. The area

offers intriguing insights into corridors of range extension for the zoogeographer and adaptation to extreme climatic conditions for the ecologist (Roberts, 1986).

Conservation Management There is no management plan.

Management Constraints The juniper forest is severely depleted, with very little natural regeneration occurring due to heavy grazing pressure from sheep and goats. Cutting of trees for fuelwood by the local people is not restricted but there is no large-scale commercial exploitation of juniper timber (Roberts, 1986). In an attempt to control infestation of parts of the juniper forest by dwarf mistletoe *Arceuthobium oxycedri*, the government has in recent years ordered the felling of over 5,000 juniper trees (Hafizullah Khan, cited in Roberts, 1986).

Staff No information

Budget No information

Local Addresses No information

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Date March 1988

SRI LANKA

Area 65,610 sq.km

Population 16.9 million (1989) **Natural Increase** 1.6% per annum

GNP US\$ 400 per capita (1987)

Policy and Legislation The 1978 Constitution of the Democratic Socialist Republic of Sri Lanka provides the foundation for the government's policies on conserving the environment. According to Chapter 6 Article 27(14) of the Constitution, "The State shall protect, preserve and improve the environment for the benefit of the community", and under Article 28F it is recognised that: "The exercise and enjoyment of rights and freedom is inseparable from the performance of duties and obligations and accordingly, it is the duty of every person in Sri Lanka to protect nature and conserve its riches."

The National Environment Act, 1980, provides a legal and institutional framework for coordinating environmental agencies and policies under the Central Environmental Authority. A serious drawback of the Act, however, is the lack of legal provisions to ensure compliance with environmental requirements. The Central Environmental Authority is also responsible for developing guidelines for environmental impact assessments, with appraisal, approval, and monitoring of development projects delegated to 15 Project Approving Agencies under various ministries. Environmental impact assessments were made mandatory for all development projects in 1984, but only the Coast Conservation Department has made provisions to enforce compliance with such assessments (Jansen, 1989). A synopsis of a national conservation strategy for Sri Lanka has recently been prepared by a task force under the Central Environmental Authority (CEA, 1988). It includes directions for the establishment of a comprehensive system of protected areas and, in the forestry sector, for the identification of forests for protection by statute.

Conservation of nature and culture are ancient traditions in Sri Lanka. King Pandukabaya marked out sanctuaries for aborigines, who always enjoyed royal protection, in the 4th century BC. One of the world's first wildlife sanctuaries was established in the 3rd century BC by King Devanampiyatissa in whose reign Buddhism was introduced to the country. Succeeding kings continued to uphold the Buddhist precept of forbidding the killing of any form of life, as is recorded on rock inscriptions throughout the country. In the 12th century AD, King Kirti-Nissanka-Mala proclaimed that no animals should be killed within a radius of seven gav (35.7km) from the city of Anuradhapura. Large tracts of forest, such as Udawattekele and Sinharaja, were protected as reserves by Sri Lankan rulers, sometimes serving as refuges for themselves, and privileged hunting was enjoyed from the earliest times in preserves specifically created for such purposes. It was not until 1885, however, with the enactment of the Forest Ordinance (No. 10), that legal provision was made to protect wildlife through the establishment of sanctuaries, first Yala (Block II of Ruhuna National Park plus the strict natural reserve) in

1900 and then Wilpattu in 1905 (Hoffmann, 1969; Crusz, 1973; Gour-Tanguay, 1977; Padmalal, 1989).

Game sanctuaries were abolished with the passing of the Fauna and Flora Protection Ordinance (No. 2) in 1937. This Ordinance, last amended in 1970, makes provision for national reserves, embodying only crown land, and sanctuaries, comprising both crown and private land. Full protection is afforded to wildlife in both reserves and sanctuaries, but in sanctuaries the habitat is totally protected on land belonging to the state while traditional human activities may continue to be practised on privately-owned land. Three categories of national reserve, *viz* strict natural reserve, national park and intermediate zone, were identified in the original legislation and a further two, *viz* nature reserve and jungle corridor, were introduced in an amendment to the Ordinance in 1964. All national reserves enjoy total habitat protection, with entry by permit only. The highest level of ecosystem preservation is afforded to strict natural reserves, with entry permitted only for scientific research. National parks provide for visitor entry (by permit) exclusively for observing the flora and fauna. Nature reserves are similar to national parks except that human activities traditionally permitted on crown land are allowed to continue. Jungle corridors provide for the safe movement of wildlife, particularly migratory elephant, in areas where human activity is permitted. Intermediate zones were formerly envisaged as buffer zones, providing for controlled hunting, but this category has since been deleted from the latest revision of the Ordinance. Activities prohibited within strict natural reserves, national parks and sanctuaries include: hunting, killing or removing any wild animal; destroying the eggs or nests of birds and reptiles; and disturbing the wild animals or interfering with the breeding of any animal. Other activities prohibited in strict natural reserves and national parks are: felling or otherwise damaging any plant; breaking up land for cultivation, mining or any other purpose; kindling or carrying fire; and possessing or using any trap, explosive or poison to damage plant or animal life. National reserves and sanctuaries may be declared, altered or abolished by ministerial order. The Fauna and Flora Protection Ordinance is administered by the Department of Wildlife Conservation.

The need for a wildlife conservation policy has long been recognised (Hoffmann, 1973). A new National Policy for Wildlife Conservation was approved by the Cabinet in June 1990. Eleven specific policy items are identified, of which the following relate specifically to protected areas: to formulate a manifesto of varied objectives which would suit each area declared for protection; to reassess ways and means of enabling existing and proposed protected areas to meet their objectives; to identify and control sustainable uses of resources within protected areas that are compatible with their objectives; to permit sustained multiple use of resources within protected areas, and zone protected areas accordingly; and to effectively manage protected areas to maintain their resource potential at natural levels. It is proposed that this policy should be incorporated into an effective Conservation Act, which should be sufficiently flexible to permit a variety of conservation practices as advocated in the policy, but should provide strong punitive measures against those who wilfully destroy national wildlife resources through personal greed or prospects of commercial gain (DWC, n.d.).

The national forest policy dates back to 1929, since when it has been modified in the 1970s and later in 1980 (Pushparajah, 1985). A salient feature of the present policy is "To maintain, conserve and create forests for the preservation and amelioration of the environment, soil and water resources and for the protection of the local fauna and flora when they are required for aesthetic, scientific, historical and socio-economic reasons." The Forest Ordinance No. 16, 1907, as amended by Act No. 13 of 1966, makes provision for the establishment of reserved

forests and village forests, and for the protection of forests and their products. The primary function of the Ordinance, however, has always been to provide for the controlled exploitation of timber. Both reserved and village forests may be declared, altered or abolished by ministerial order. The term reserved forest is interpreted as including plantations and chenas (cultivations established under slash-and-burn practices). Activities prohibited within reserved forests include: trespass by persons or their cattle; felling trees or collecting forest produce; poisoning water; quarrying stone and burning lime or charcoal; making fires or fresh clearings; breaking up land for cultivation or any other purpose; constructing temporary or permanent buildings, sawpits, or roads; and pasturing cattle, hunting, shooting or fishing in contravention of any ministerial regulations. Any portion of a forest may be constituted a village forest for the benefit of a village community. Activities prohibited within village forests include: poisoning of water, and injuring by fire or other means any tree listed in Schedule I of the Ordinance. Management of village forests, including pasturing of cattle, is subject to ministerial regulations.

To overcome the inherent weaknesses in the Forest Ordinance, the National Heritage Wilderness Areas Act, No. 3 was passed in 1988. Any piece of state land having unique ecosystems, genetic resources or outstanding natural features (including the habitat of threatened species) may be declared a national heritage wilderness area by the minister, subject to the approval of the president and endorsement by parliament. Other provisions include the acquisition of land, the preparation of a management plan by the competent authority (Conservator of Forests) in respect of areas declared under the Act, and the over-riding of anything contradictory in the provisions of any other written law other than the Constitution. Entry to a national heritage wilderness area is by permit and restricted for purposes of observing the fauna and flora or conducting scientific research. Both the Forest Ordinance and National Heritage Wilderness Areas Act are administered by the Forest Department.

Other legislation concerned with the conservation of natural resources is reviewed by Cruz (1973), Gour-Tanguay (1977), NPS (1985), Jansen (1989) and, in the case of marine resources, UNEP/TUCN (1988). Special attention has been given to coastal and marine areas under the Coast Conservation Act (No. 57), 1981, which provides for the protection of the coast from erosion or encroachment by the sea and includes the planning and management of development activity within the coastal zone, defined as the area between 300m landwards of the mean high water line and 2km seawards of the mean low water line (Wijewansa, 1985). Under this Act, which is administered by the Coast Conservation Department, sites can be designated as critical habitats for protection (non-development areas).

In general, much of the legislation relating to natural resources has not kept abreast with the changing needs of society and is oriented towards the exploitation rather than sustainable use of such resources. Some laws have suffered from a lack of implementation for social, economic or political reasons, while others have remained fragmentary, with responsibilities spread among a multiplicity of agencies and institutions (Jansen, 1989). In the case of the Fauna and Flora Protection Ordinance, the lack of any criteria to differentiate between the various designations of protected area has resulted in inconsistent application of this system of classification. The national park designation, for example, has been used for some areas which are uninhabited and others, notably in the Mahaweli development area, which have a human population (Bere, 1959; Alwis, 1969; NPS, 1985). The Ordinance is being amended to provide *inter alia* for the creation of new categories of reserve, such as buffer zones, refuges, wetlands and marine reserves, and to enhance the present grossly inadequate penalties for infringements (Hoffmann, 1983; Jansen, 1989).

International Activities At the international level, Sri Lanka has entered a number of obligations and cooperative agreements related to conservation. It is party to the Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) which it accepted on 6 June 1980. One natural site, Sinharaja National Heritage Wilderness Area, has been inscribed to date and initiatives are underway to nominate several more natural sites.

Sri Lanka became a contracting party to the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) on 15 October 1990, at which time Bundala Sanctuary was included in the List of Wetlands of International Importance established under the terms of the Convention.

Sri Lanka participates in the Unesco Man and Biosphere Programme (Bharathie, 1979). To date 47 national biosphere reserves have been declared by the Forest Department, of which Sinharaja and Hurulu are designated as part of the international biosphere reserve network.

Sri Lanka is one of seven countries cooperating in the South Asian Cooperative Environmental Programme, which was launched in the 1980s to ameliorate the environment in the region, particularly regarding montane, mangrove, island and marine ecosystems, through legislation, education and training (Rau, 1984).

Administration and Management Under the provisions of the Fauna and Flora Protection Ordinance, the Department of Wildlife Conservation is responsible for wildlife conservation and protected areas management. The Department was set up in 1949 as the Wildlife Conservation Department, prior to which all matters relating to wildlife fell within the remit of the Forest Department. The first warden (director) was appointed in December 1950, and the Department became fully functional as an independent unit in 1957 (Bere, 1959; Alwis, 1969). Originally under the Ministry of Lands and Land Development, and subsequently the Ministry of Tourism and Shipping (1970-1977) and Ministry of State (1960s and 1980s), the Department of Wildlife Conservation was transferred to the Ministry of Lands, Irrigation and Mahaweli Development in 1989. It is headed by a director, under whom are three deputy directors in charge of administration, technical, and veterinary and research divisions, respectively. Field staff are deployed mostly in the national reserves and marginally outside them. The Department has recently taken on responsibility for the Mahaweli Environment Project, begun in 1982 as part of the Accelerated Mahaweli Development Programme. The Mahaweli Environment Project has been concerned with the development and management of a system of protected areas in the Mahaweli Ganga and adjacent river basins. The Department is presently being re-structured in view of the urgent need to upgrade and develop its services. A five-year development plan has been prepared for submission to donor agencies for funding (Kotagama *et al.*, 1990).

The Forest Department, under the provisions of the Forest Ordinance, is *inter alia* responsible for the protection and management of natural and plantation forests, including any declared as biosphere reserves. It is headed by a conservator of forests, supported by seven deputy conservators of forests, 13 assistant conservators of forests, and a number of foresters and forest rangers. The recent Forestry Master Plan, 1985-2020 (Jaakko Poyry International Oy, 1986) has received much criticism because of its bias towards the exploitation of timber and fuelwood, with little regard to the ecological, hydrological, social and aesthetic values of forests (Fernando and Samarasinghe, 1988; Jansen, 1989). In response to public agitation, the Plan was reviewed by

IUCN and a conservation strategy for natural vegetation types is now due to be incorporated into the Plan. In the meantime, an immediate moratorium on further selective logging or conversion to other any form of land use has been recommended, until such time as natural forests are evaluated with regard to their conservation value in maintaining biological diversity and environmental stability (IUCN, 1989).

Conservation of natural resources outside protected areas falls within the mandate of a number of other agencies. The Coast Conservation Department, Ministry of Fisheries, is responsible for planning and managing activities within the coastal zone, including the conservation of marine and coastal resources. Similarly, the National Aquatic Resources and Research Agency, set up under the National Aquatic Resources Research and Development Agency Act (No. 54), 1981, is concerned *inter alia* with the management and conservation of aquatic resources in the inland waters, 200-mile exclusive economic coastal zone and in the deep seas. The Natural Resources, Energy and Science Authority of Sri Lanka was set up to coordinate scientific activity within the country and to advise the President on matters pertaining to the application of science and technology. It has ten working committees, including one for natural resources, and also functions as the focal point for international activities in science and technology. The National MAB Committee, for example, is placed under this authority. The Central Environmental Authority, created in 1981, was intended to be at the apex of governmental agencies concerned with environmental matters. Included within its mandate has been the preparation of a national conservation strategy. To date it has served largely in an advisory capacity, its effectiveness having been limited by its inability to influence the actions of agencies outside its own Ministry of Local Government and Housing (Jansen, 1989).

Non-governmental organisations have recently played an active role in mobilising public opinion and lobbying government on national conservation issues, often successfully as in the case of the Sinharaja rain forest or the national Forestry Master Plan. They have also directly supported various conservation programmes, complementing the work of government agencies. Most non-governmental organisations are registered with the Central Environmental Authority. Some of the more important ones are represented on various national committees, such as the Fauna and Flora Advisory Committee, and the Environmental Council of the Central Environment Authority.

By far the largest and oldest conservation non-governmental organisation is the Wildlife and Nature Protection Society. Originally established on 23 May 1894 to cater for sport-hunting interests, and later incorporated by Act of Parliament in 1968, the Society has become increasingly concerned with the conservation of the island's biological resources through negotiation and cooperation with the state. The Society has about 4,000 members. It produces a biannual wildlife journal, *Loris*. More recently, in 1980, March for Conservation was set up to focus attention, through education, training and research, on the rapid degradation of the island's natural resources. Its particular strength lies in the university basis of its 300 members, providing it with a strong research capability. Members have undertaken research in the Sinharaja rain forest, national parks, coastal zones and the Mahaweli development area. The organisation publishes scientific literature on natural resource issues, and has been instrumental in forming rural-based conservation societies, particularly in the vicinity of the Sinharaja rain forest. The Nation Builders Association is a rural-based organisation, composed largely of village youth and involved in forestry activities mainly in Kandy District. The Sri Lanka Environment Foundation provides the legal teeth to the non-governmental environmental movement. It comprises a group of young lawyers with a mandate to protect the country's natural resources

from damaging activities through legal action. Other non-governmental organisations include the Sri Lanka Association for the Advancement of Science, which provides a forum for scientists of all disciplines to promote and advance the sciences, and the Ceylon Bird Club, which has maintained bird records for nearly 50 years and has organised mid-winter waterfowl counts since 1983. Limited financial resources and the lack of time of volunteer members to devote to the conservation effort is a serious constraint. A step in the right direction was taken in 1985 when a number of these voluntary groups joined together under the umbrella of the Sri Lanka Environment Congress in order to pool their resources to generate a more powerful and united front to the environment movement. Further details of these and other voluntary organisations are given elsewhere (Hoffmann, 1969; Wijewansa, 1985; Jansen, 1989).

There are a number of constraints to the effective protection of reserves. Both the Department of Wildlife Conservation and the Forest Department are severely handicapped by a lack of financial resources to administer such areas effectively. Forest reserves, in particular, are often unstaffed with the result that few of the smaller ones exist on the ground, while many of the larger ones are heavily encroached. Enforcement measures are handicapped by the absence of clear-cut boundaries that are easily recognisable on the ground. Lack of local involvement in protected areas is limiting their effectiveness. Political interference is a further obstacle to natural resource conservation (Anon., n.d.; Hoffmann, 1983; Jansen, 1989).

Systems Reviews Sri Lanka became an island probably in the late Miocene. It consists of a south-central massif, rising to some 2,500m, surrounded by a coastal plain which encompasses about 75% of the total geographic area. The massif has a major influence on the climate, with conditions ranging from wet in the south-west to dry in the north and east. Radiating from this massif is a network of major rivers (Fernando, 1984). These features are largely responsible for the wide variety of ecosystems present in Sri Lanka and the associated rich diversity of plants and animals, many of which occur in the wet zone and are endemic (Wijesinghe *et al.*, 1989).

The pattern of land use has been strongly influenced by the different climatic zones. The first major changes in land-use patterns took place during the colonial era when forests in the wet zone were cleared for cultivation of coconut and rubber in the lowlands and coffee, later to be replaced by tea, in the uplands (Jansen, 1989). The wet zone, which receives in excess of 2540mm of rainfall per year, is now densely populated and intensively used for agriculture, with little potential for further expansion. The dry zone, on the other hand, until about the 13th century AD the centre of a highly advanced civilisation based on irrigated agriculture, receives less than 1905mm of rainfall annually, is sparsely populated and offers the greatest opportunities for agricultural expansion in conjunction with irrigation schemes. In the face of a lack of food, overpopulation and unemployment in the wet zone, the former colonial government devised a scheme under the Land Development Ordinance, 1935, to translocate peasant farmers and the unemployed from the wet zone to the dry zone (Drijver *et al.*, 1985). After independence, the Sri Lankan government developed the scheme into the much more ambitious Mahaweli Development Programme, with the accelerated phase scheduled for completion in 1986-1987. This is one of the largest development schemes ever undertaken in South Asia, with 360,000ha of land in the basins of the Mahaweli Ganga and the south-eastern rivers irrigated for agricultural purposes for the benefit of nearly one million people to be settled in the area (Wijewansa, 1985). A major limiting factor, however, is the availability of water which will be enough for year-round irrigation of only 200,000ha (Perera, 1984).

The main forest types are the tropical wet evergreen (below 1,000m) and montane (above 1,000m) forests of the wet zone, tropical moist/wet semi-evergreen forests of the intermediate zone, tropical dry mixed evergreen forests of the dry zone and semi-evergreen thorn forest of the arid zone. Large tracts of forest have been cleared during the last hundred years to accommodate the growing human population, which has risen from 3.5 million in 1900 through 5 million in 1950 to nearly 15 million by 1980. Natural forest cover has dwindled rapidly from an estimated 89% in 1889 to 46.5% in 1956 and 28% in 1981-1983 (Nanayakkara, 1987). The annual rate of deforestation of closed forest (3.5%) was among the highest in the world for the period 1981-1985 (Repetto, 1988). It has been estimated from the Forest Cover Map produced by the Survey Department in 1981, which is based on satellite imagery supplemented by ground-truthing, that natural forest cover had shrunk to 24.9% by 1981, of which only 1.5% comprised lowland wet-zone forest, biologically the most valuable forest type. This estimate is lower than the later figure of 28% natural high forest for mid-1983 derived from the FAO inventory (Forest Department, 1986). According to the latest available data, natural forest cover is about 22% (Somasekaram, 1988).

The wetlands of Sri Lanka comprise a variety of coastal and inland systems, ranging from estuaries, lagoons and mangroves to rivers, villus and tanks (reservoirs). Many of the tanks date back 1,500 years when they formed part of an intricate irrigation system for rice cultivation. In recent decades, several large reservoirs have been constructed as part of large-scale hydro-power and irrigation projects, notably in the Mahaweli catchment area. There are over 10,000 tanks in Sri Lanka, of which 3,500 are considered to be significant water bodies. Only 60 of these exceed 300ha in size. The wetlands support a variety of wildlife, as well as being of socio-economic importance, particularly for irrigation purposes (Scott, 1989).

Coral reefs are reported to be most extensive off the eastern coast, although the Basses off the south-east coast and those of Dutch Bay off the north-west coast are among the most spectacular. Reef resources are reviewed in UNEP/IUCN (1988).

The present growing awareness of the need to conserve the island's natural resources can be traced back to at least 1873 when the colonial government warned against the replacement of natural forests with plantations in view of its serious impact on the climate (Hooker, 1873 cited in Jansen, 1989). Many years later, in 1938, a law prohibiting the clearing of forests above 1,500m was enacted. Despite such efforts, forests continued to be maximally exploited for timber until the 1960s. A major initiative begun in the early 1980s was the provision of a network of protected areas under the Mahaweli Environment Project to mitigate the impact of the Accelerated Mahaweli Development Programme (Jansen, 1985). This initiative followed in the wake of environmental assessments carried out by TAMS (1981,1982), and needs for environmental action were subsequently identified in a study commissioned by the European Community (Driver *et al.*, 1985).

Sri Lanka currently has a fairly extensive system of protected areas, covering over 12% of its total land area, but it is not comprehensive. Priorities to develop the existing network are identified in the IUCN systems review of the Indomalayan Realm (MacKinnon and MacKinnon, 1986), and specific recommendations are made in the Corbett Action Plan (IUCN, 1985). While most habitats are represented within the existing protected areas system, most of the major conservation areas lie within the dry zone. Coverage of tropical wet evergreen and hill forests is still far from adequate (MacKinnon and MacKinnon, 1986). Here lie a number of floristically important regions, such as the forests of Kottawa, Hinidumkanda, Kanneliya and Gilimale,

which have not been allocated for conservation (Gunatilleke and Gunatilleke, 1990). In the case of the Knuckles Range, it is to be the subject of a conservation plan. Demarcation of protected areas in the wet zone is considered to be a high priority in the new national wildlife conservation policy (DWC, n.d.). Other gaps in the network include coastal and marine protected areas, the only one established to date being Hikkaduwa Marine Sanctuary (Kotagama *et al.*, 1990). In the dry zone, important areas with inadequate conservation status include the Samanlawewa area in the Walawe Ganga basin and the core of the Minneriya-Giritala Nature Reserve (T.W. Hoffmann, pers. comm., 1990). Clearly, these and other deficiencies in the existing network need to be addressed through a comprehensive systems review which has never been carried out at the national level.

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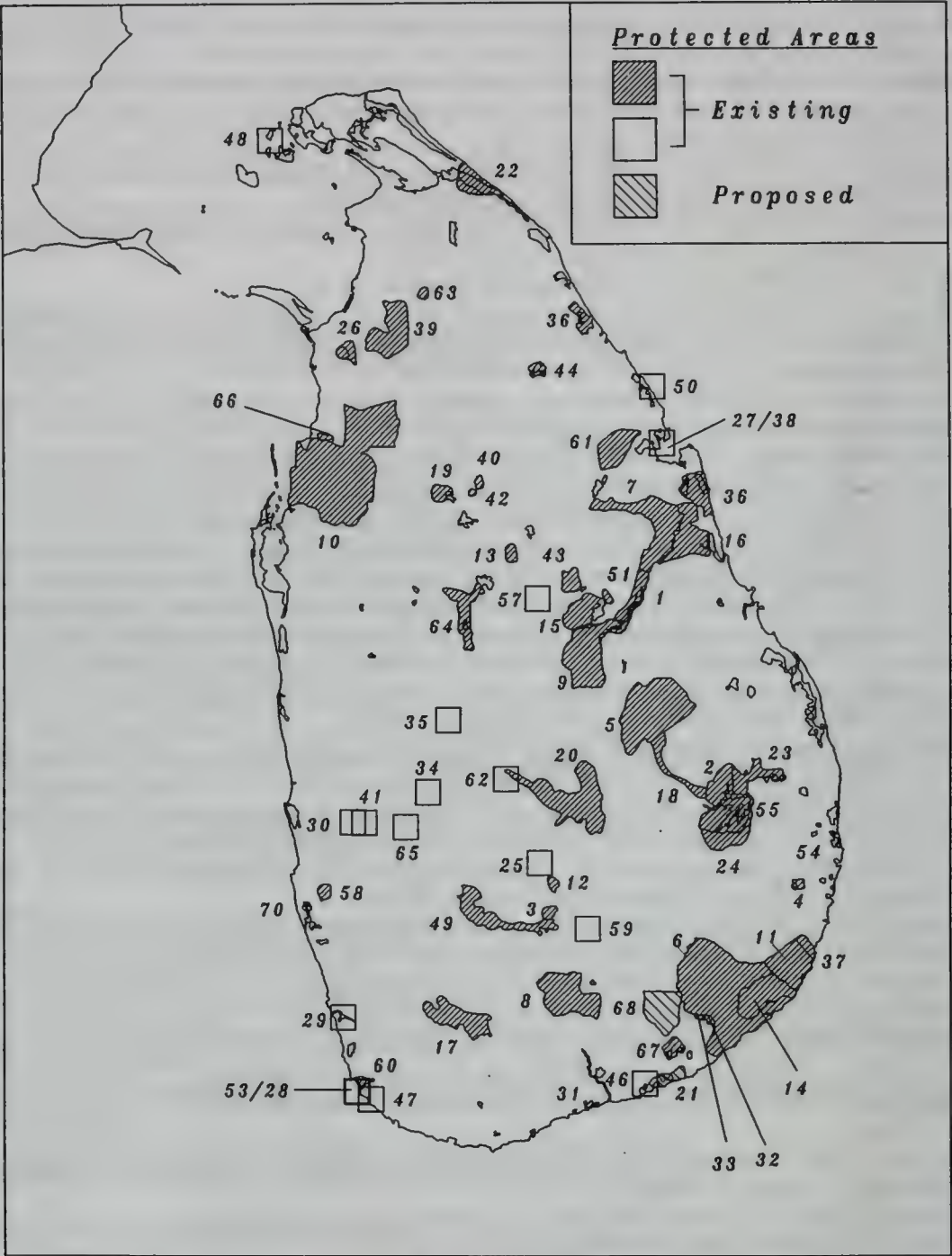
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□ indicates protected area where the boundary is not shown

Protected Areas of Sri Lanka
Numbers correspond to those in the summary

Summary of Protected Areas of Sri Lanka

<i>National/International designation</i> Name of area and map reference ¹	IUCN Management category	Area (ha)	Year notified
<i>Biosphere Reserves</i>			
Hurulu Forest Reserve*	IX	512	1977
17 Sinharaja Forest Reserve*	IX	8,864	1978
<i>Ramsar Wetlands</i>			
21 Bundala Sanctuary*	IV	6,216	1990
<i>World Heritage Sites</i>			
17 Sinharaja National Heritage Wilderness Area*	X	8,864	1988
<i>National Parks</i>			
1 Flood Plains *	II	17,350	1984
2 Gal Oya *	II	25,900	1954
3 Horton Plains *	II	3,160	1988
4 Lahugala Kitulana *	II	1,554	1980
5 Maduru Oya *	II	58,850	1983
6 Ruhuna (Yala)*	II	97,878	1938
7 Somawathiya Chaitiya *	II	37,762	1986
8 Uda Walawe *	II	30,821	1972
9 Wasgomuwa *	II	37,063	1980
10 Wilpattu *	II	131,693	1938
11 Yala East *	II	18,149	1969
Subtotal (% total land area)		460,180	(7.0%)
<i>Strict Natural Reserves</i>			
12 Hakgala *	I	1,142	1938
13 Ritigala *	I	1,528	1941
14 Yala *	I	28,904	1938
Subtotal (% total land area)		31,574	(0.5%)
<i>Nature Reserves</i>			
15 Minneriya-Giritale	IV	7,529	1988
16 Tirikonamadu *	IV	25,019	1986
Subtotal (% total land area)		32,548	(0.5%)

National Heritage Wilderness Areas

17	Sinharaja *	IV	7,648	1988
Subtotal (% total land area)			7,648	(0.1%)

Jungle Corridors

18	Nilgala	Unassigned	10,360	1970
Subtotal (% total land area)			10,360	(0.2%)

Sanctuaries

19	Anuradhapura	IV	3,501	1938
20	Buddhangala	IV	1,841	1974
21	Bundala *	IV	6,216	1969
22	Chundikulam *	IV	11,150	1938
23	Gal Oya Valley North-East*	IV	12,432	1954
24	Gal Oya Valley South-West *	IV	15,281	1954
25	Galway's Lands	IV	57	1938
26	Giant's Tank *	IV	3,941	1954
27	Great Sober Island	IV	65	1963
28	Hikkaduwa Marine *	IV	45	1979
29	Honduwa Island	IV	8	1973
30	Horagolla	IV	13	1973
31	Kalametiya Kalapuwa *	IV	712	1984
32	Katagamuwa	IV	1,004	1938
33	Kataragama	IV	838	1938
34	Kegalle	IV	113	1941
35	Kimbulwanoya	IV	492	1963
36	Kokilai *	IV	2,995	1951
37	Kudumbigala	IV	4,403	1973
38	Little Sober Island	IV	6	1963
39	Madhu Road	IV	26,677	1968
40	Mahakandarawewa	IV		1966
41	Maimbulkande-Nittambuwa	IV	23	1972
42	Mihintale	IV	1,000	1938
43	Minneriya-Giritale *	IV	6,693	1938
44	Padaviya Tank	IV	6,475	1963
45	Pallekele-Kahalla-Balaluwewa	IV	21,690	1989
46	Pallemalala	IV	14	1942
47	Parapuduwa Nuns Island	IV	190	1988
48	Parititivu Island	IV	18	1973
49	Peak Wilderness *	IV	22,380	1940
50	Pigeon Island	IV	5	1974
51	Polonnaruwa *	IV	1,523	1938
52	Ravana Ella	IV	1,932	1979
53	Rocky Islets (Ambalangoda)*	IV	1	1940
54	Sagamam	IV	616	1963
55	Senanayake Samudra *	IV	9,324	1954
56	Seruwila-Allai *	IV	15,540	1970

57	Sigiriya *	IV	5,099	1990
58	Sri Jayewardenepura	IV	449	1985
59	Tangamalai (Adhisham)	IV	132	1938
60	Telwatte	IV	1,424	1938
61	Trincomalee Naval Headworks	IV	18,130	1963
62	Udawattekele *	IV	111	1938
63	Vavunikulam	IV	4,856	1963
64	Victoria-Randenigala-Rantambe *	IV	42,087	1987
65	Welhella-Katagille	IV	134	1949
66	Wilpattu North *	IV	624	1947
67	Wirawila-Tissa *	IV	4,164	1938
Subtotal (% total land area)			256,424	(3.9%)

Proposed

21	Bundala *	Proposed	6,216
68	Lunugamvihira	Proposed	21,500
69	Riverine	Proposed	921
70	Bellanwila-Attidiya Marshes*	Proposed	60
71	Dutch Bay (+ Portugal Bay)	Proposed	

TOTALS

Existing areas (% total land area)	798,734	(12.2%)
Proposed areas (% total land area)	28,697	(0.4%)

¹Locations of most protected areas are shown in the accompanying map.

*Site is described in this directory.

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BELLANWILLA-ATTIDIYA MARSHES SANCTUARY

IUCN Management Category Proposed

Biogeographical Province 4.02.01 (Ceylonese Rainforest)

Geographical Location Situated on the coastal plains of the wet zone in the south-eastern outskirts of Colombo, east of Attidiya, Colombo District, Western Province. 6°50'N, 79°54'E

Date and History of Establishment Proposed as a sanctuary by the Department of Wildlife Conservation.

Area 60ha

Land Tenure The marshes are state owned; surrounding areas are mostly privately owned.

Altitude Sea level

Physical Features Comprise a complex of shallow freshwater ponds, marshes and seasonally flooded grasslands, with scattered shrubs and small trees. Bolgoda Canal divides the marshes into almost equal portions. Numerous shallow pools and muddy areas have been created by water buffalo. The area was cultivated for rice until 1980, but has since reverted to marshland.

Climate Conditions are tropical monsoonal.

Vegetation Open water areas are almost entirely covered by *Salvinia* sp. and *Eichhornia crassipes*. Most of the marsh is covered with low reeds and grasses, with some patches of tall reeds and bushes.

Fauna The marsh supports small numbers of a wide variety of waterbirds, and is an important roosting site for herons and egrets. Some 43 species of waterfowl were recorded in 1986 and 1987. These included several species scarce in Sri Lanka, such as Indian cormorant *Phalacrocorax fuscicollis*, blue-breasted banded rail *Rallus striatus* and ruddy-breasted crake *Porzana fusca*, as well as grey pelican *Pelecanus philippensis*, black bittern *Ixobrychus flavicollis*, painted stork *Mycteria leucocephala*, Asian open-billed stork *Anastomus oscitans*, Oriental ibis *Threskiornis melanocephalus*, spoonbill *Platalea leucorodia*, Indian whistling duck *Dendrocygna javanica*, water cock *Gallicrex cinerea*, purple swamphen *Porphyrio porphyrio* (a common breeding bird), pheasant-tailed jacana *Hydrophasianus chirurgus*, painted snipe *Rostratula benghalensis* and a variety of migratory shorebirds.

Mammals include otter *Lutra* sp., mongoose *Herpestes* sp., jackal *Canis aureus* and mouse deer *Tragulus meminna*. Mugger *Crocodylus palustris* (V) is present (Sumanasena, n.d.). Thirty-nine species of fishes have been recorded, including four of Sri Lanka's endemic species. The marsh is also rich in butterflies (52 species including nine endemics) and dragonflies (37 species).

Cultural Heritage No information

Local Human Population Less than 20 people live in the marshes, but over 10,000 live in the immediate vicinity. Activities include fishing for finfish and shrimps, livestock grazing (water buffalo and cattle), and cutting of reeds and shrubs for fuel. The surrounding areas are settled or cultivated.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Members of the Young Zoologists' Association in Colombo carried out an ecological study of the marsh in 1986-1987.

Conservation Value The marshes are among the most important of the few remaining wetlands around Colombo. Because of their easy access and close proximity to Colombo, they have excellent potential for conservation education and scientific research.

Conservation Management Various recommendations for managing the proposed sanctuary have been outlined by Gunawardana (1988).

Management Constraints Effluents from a nearby garment factory are discharged into Bolgoda Canal, resulting in high fish mortality. Several species of fishes, including two of Sri Lanka's endemic species *Aplocheilus dayi* and *Ehiwara fluviatilis*, and the economically important freshwater shrimp *Macrobrachium rosenbergii*, have been almost exterminated from the marshes. The dumping of domestic waste along adjacent roads has also contributed to the pollution. Most of the larger trees have been cut down for firewood. There is a considerable amount of hunting of large waterbirds, using snares, nets and catapults, and some egg-collecting.

Staff None

Budget None

Local Addresses None

References Unless otherwise indicated, information is taken directly from Scott (1989).

Gunawardana, J. (1988). A general assessment of the Bellanwila-Attidiya Marshes. Ceylon Bird Club, Colombo. Unpublished report. (Unseen)

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Date September 1990

BUNDALA SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies on the south coast in South Province, about 274km from Colombo. Stretches from the vicinity of Bundala Village in the east to that of Hambantota township in the west. Part of the northern boundary is contiguous with the A2 main road. 6°07'-6°14'N, 81°07'-81°17'E

Date and History of Establishment Declared a sanctuary on 5 December 1969 (Gazette No. 44,883). Designated a Wetland of International Importance at the time of Sri Lanka's ratification of the Ramsar Convention on 15 October 1990.

Area 6,216ha

Land Tenure Land is state owned, except for the lands along the northern boundary between Koholankala and Pallemalala released to villagers for settlement, and the paddy fields at Koholankala and Malala. Bundala, Koholankala, and Mahalewayas have been leased to the National Salt Corporation for salt production.

Altitude Ranges from sea level to 10m.

Physical Features The sanctuary contains five shallow, brackish lagoons with salt pans in three, interconnecting channels and marshes including the adjacent coast. The easternmost lagoon, Bundala Lewaya, was originally a brackish lagoon of about 520ha in extent, separated from the sea by a natural sand-bar and with a mean depth of less than 1m. A large part of this lagoon has now been converted to salt pans by a series of earth bunds, and developed as a saltern. Immediately to the west is Emilikala Kalapuwa, a fresh/brackish lagoon of about 430ha. It is 1-2m in depth, and overflows into Malala Lagoon via a natural channel. Malala Lagoon, in the middle of the sanctuary, is about 650ha in extent, fresh/brackish, and 1-2m in depth. It is fed by the Malala Oya, which receives drainage water from both the Walawe Multipurpose Irrigation Development Scheme and the Kirindi Oya Irrigation Settlement Scheme. Thus, fresh water inflow to Embilikala and Malala lagoons has increased considerably with the result that fluctuating salinity levels have adversely affected their ecology. Malala Lagoon, which is separated from the sea by a naturally-formed sand-bar, only drains into the sea during floods or when the sand-bar is breached by local fishermen to facilitate fishing in the lagoon. Koholankala Lewaya, about 390ha in extent, drains into Mahalewaya (260ha) in the extreme west of the sanctuary. Koholankala Lewaya and Mahalewaya have been almost totally developed for salt production. Both lagoons are less than 1m deep and subject to wide fluctuations in water level. Salinity in Koholankala Lewaya exceeds 30 p.p.t. during dry periods. The terrain surrounding the lagoons is generally flat, with sand dunes along the coast and sparse dry evergreen *Acacia* scrub inland. Fresh water springs are found along the dune belt.

Climate Conditions are tropical monsoonal, with a mean annual temperature of 27°C. Annual rainfall ranges from 900mm to 1300mm, with an extensive dry period from May to September.

Vegetation The phytoplankton in all the lagoons is dominated by blue-green algae, such as *Microcystis*, *Nostoc* and *Oscillatoris*, while hydrilla abound in Embilikala and Malala. Marshes and streams contain water hyacinth, water lilies and reed beds of *Typha javanica*. The arid vegetation consists largely of grass flats studded with *Acacia* scrub, comprising andara *Dichrostachys cinerea*, kukuruman *Randia dumetorum*, eraminiya *Ziziphus* sp., *Ceymnosporia emarginata*, karamba *Carissa spinarum*, *Capparis zeylanica* and *Cassia* spp., and stands of forest scrub, comprising maila *Bauhinia racemosa*, mallittan *Salvadora persica*, weera *Drypetes sepiaria*, palu *Manilkara hexandra* and less frequently satin *Chloroxylon sweetania*, kohomba *Azadirachta indica* and divul *Feronia limonia*.

Fauna The forest still harbours a few elephant *Elephas maximus* (E), and migratory herds of up to 80 animals have been seen in the area (Banks and Banks, 1985). Other mammals include endemic toque macaque *Macaca sinica*, common langur *Presbytis entellus*, jackal *Canis aureus*, leopard *Panthera pardus* (T), fishing cat *Felis viverrinus*, rusty-spotted cat *Felis rubiginosa*, mongoose *Herpestes* spp., wild boar *Sus scrofa*, mouse deer *Tragulus meminna*, Indian muntjac *Muntiacus muntjak*, spotted deer *Cervus axis*, sambar *C. unicolor*, black-naped hare *Lepus nigricollis*, Indian pangolin *Manis crassicaudata* and porcupine *Hystrix indica* (N. Ishwaran, pers. comm., 1986.).

Noteworthy amphibians include the endemic frog *Bufo athukoralei*. Among reptiles, mugger *Crocodylus palustris* (V), estuarine crocodile *C. porosus* (E), common monitor *Varanus bengalensis* and star tortoise *Testudo elegans* have been recorded (Banks and Banks, 1986). Reptiles also include python *Python molurus* (V), rat snake *Pythas mucosus*, endemic flying snake *Chrysopelea taprobana*, cat snakes *Boiga* spp. and whip snakes *Dryophis* spp. (Banks and Banks, 1986; M. Jansen, pers. comm., 1986). The beach along the coastal belt is a favourite nesting ground for sea turtles.

The sanctuary is the home of every species of waterbird resident in the country and, during the northern winter, it is the final destination for countless numbers of waders of most species recorded in Sri Lanka. The rare black-necked stork *Ephippiorhynchus asiaticus* is an infrequent visitor. Vagrants turn up occasionally and among those reliably reported from the area are Caspian plover *Charadrius asiaticus*, common ringed plover *C. hiaticula*, spotted redshank *Tringa erythropus*, terek sandpiper *Xenus cinereus*, red knot *Calidris canutus*, broad-billed sandpiper *Limicola falcinellus*, buff-breasted sandpiper *Tryngites subruficollis*, red-necked phalarope *Phalaropus lobatus*, spoon-billed sandpiper *Eurynorhynchus pygmaeus*, common avocet *Recurvirostra avosetta* and Eurasian oystercatcher *Haematopus ostralegus*. Both white-bellied sea-eagle *Haliaeetus leucogaster* and brahmyny kite *Haliastur indus* are breeding residents (Banks and Banks, 1986, pers. comm., 1986). Up to 2,000 greater flamingos *Phoenicopterus roseus* have been seen during the north-east monsoon (A.B. Fernando, pers. comm., 1990). Details of waterfowl counts are given by Scott (1989).

Cultural Heritage No information

Local Human Population From time immemorial the lagoons have supported a subsistence fishery for the local inhabitants. Village cattle are also allowed to graze in the sanctuary; dead wood is gathered from the periphery for use as fuel; and medicinal herbs and honey are collected

by the people living on the edge of the sanctuary. Rice is grown on the northern shores of Embilikala, Malala and Koholankala, but the crop often fails due to high salinity levels.

Visitors and Visitor Facilities From 20 to 30 parties visit the sanctuary in jeeps daily. Visitors may walk in the sanctuary. The National Salt Corporation has a circuit bungalow at Bundala Lewaya. Accommodation is available outside the sanctuary at Tissamaharama, Wirawila and Hambantota, from where jeeps can be hired. There used to be an airstrip at Wirawila suitable for two-seater aircraft.

Scientific Research and Facilities Numerous waterfowl and shorebird censuses have been carried out. A National Sea Turtle Conservation Project was started at Bundala in 1987 by the National Aquatic Resources Agency with the support of the Department of Wildlife Conservation. A research hut was constructed and preliminary surveys undertaken, but suspended temporarily mid-1988 due to security problems.

Conservation Value Bundala is the most important wetland for birds in Sri Lanka outside the Northern Province. Its lagoons are among the most important wintering areas for migratory shorebirds in the country, regularly accommodating over 15,000 shorebirds at any one time. It is the last refuge of the greater flamingo in this part of the island, as well as being important for elephant and a variety of threatened reptiles. Dense thorny scrub provides a natural barrier to the gale-force winds that would otherwise accelerate desertification in this arid countryside.

Conservation Management The sanctuary was established largely to protect migratory waterfowl, an initiative which originally attracted a considerable outcry from sportsmen (Anon. 1964). At present, fishing in the lagoons and visitation for study, observation and photography are permitted without any restriction. A proposal has been made to upgrade the sanctuary to a national park, but, in view of the traditional activities presently enjoyed by the local people and the salt production operations of the National Salt Corporation, it is felt that initially the sanctuary should be upgraded to a nature reserve and human activities controlled to some extent. While more wildlife staff need to be stationed at strategic locations in the area to afford it the necessary protection, it is also important to provide some basic facilities for campers and other visitors for study and observation of wildlife, photography and particularly bird watching. It is also of paramount importance to restore two or three small waterholes with windmill-operated tube wells and create freshwater sources for wildlife.

Management Constraints The degree of protection afforded to the sanctuary is limited. Apart from the traditional activities of the local people, such as subsistence fishing in the lagoons, grazing livestock and collecting fuelwood, other activities such as fishing by migrant fishermen, mining, collection of mollusc shells for lime and tourism have increased considerably in recent years. A firing range, recently opened in the sanctuary by the Sri Lanka Air Force, has been closed down following representations by the Department of Wildlife Conservation and other conservation bodies. The Department has also been successful in stopping the Ceramic Corporation issuing permits for mining molluscs from beds in the sanctuary, but one or two private lime kilns still continue to operate at Fallemalala. While poaching, cutting and removal of timber, and encroachment of land are minimal, uncontrolled tourism is the source of much disturbance. Tour operators, based at Tissamaharama and Hambantota, harass elephants and drive off the tracks for the benefit of their clients. Recently, a foreign tourist was trampled and killed by a bull elephant.

Staff One senior wildlife ranger based at Hambantota, and one range assistant and three game guards based in Bundala Sanctuary

Budget No information

Local Addresses Senior Wildlife Ranger, Bundala Sanctuary, Southern Headquarters, Department of Wildlife Conservation, Hambantota

References Information is taken from the Ramsar nomination, unless otherwise indicated.

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Date April 1986, updated September 1990

CHUNDIKKULAM SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Situated at the base of the Jaffna Peninsula, east of Elephant Pass, Jaffna District, Northern Province. 9°26'-9°32'N, 80°24'-80°37'E

Date and History of Establishment Declared a sanctuary for birds under the Fauna and Flora Protection Ordinance on 25 February 1938.

Area 11,150ha

Land Tenure State

Altitude Sea level

Physical Features Comprises a large brackish lagoon with some fringing mangroves and seagrass beds. The lagoon was saline, having once formed part of the Jaffna Lagoon system. The extensive Government saltern (salt producing area) on the western side of Elephant Pass causeway has permanently disrupted the former tidal connection between Chundikkulam and Jaffna lagoons. With the closure of Elephant Pass causeway at the west end, the salinity of the lagoon is said to have decreased, and large areas now dry out during the dry season (April to September). Numerous small streams enter the lagoon along its southern shore.

Climate Conditions are tropical monsoonal.

Vegetation Consists of mangrove swamps and seagrass beds, with plantations of palms *Palmyra* and scrub forest in surrounding areas.

Fauna The avifauna includes a wide variety of waterfowl, notably painted stork *Mycteria leucocephala*, Oriental ibis *Threskiornis melanocephalus*, spoonbill *Platalea leucorodia*, migratory ducks, coot *Fulica atra*, migratory shorebirds, gulls and terns. Waterfowl observed in the winter of 1982/1983 included 4,000 pintail *Anas acuta* and 6,300 garganey *A. querquedula*.

Cultural Heritage No information

Local Human Population Activities include prawn fishing, salt production and cultivation of palms in adjacent areas. The lagoon supports a subsistence fishery.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Some waterfowl censuses have been carried out.

Conservation Value The sanctuary is of great importance for a wide variety of waterfowl.

Conservation Management No information

Management Constraints The isolation of the lagoon from tidal influence has undoubtedly had major ecological consequences, but these have never been studied. A salt water exclusion scheme was started but later abandoned. There are plans to revive the scheme again, but the Ceylon Bird Club has strongly protested against this initiative prior to assessing carefully environmental impact. The sanctuary has never been adequately protected, and has been open to a variety of abuses. Parts of the lagoon are used for aquaculture, and the surrounding forests are being cleared.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:
Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date September 1990

FLOOD PLAINS NATIONAL PARK

IUCN Management Category II (National Park)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Spans the Mahaweli Ganga in Polonnaruwa District, North Central Province. The township of Manampitiya lies just outside the eastern boundary of the park, a stop-over on the Batticaloa-Polonnaruwa road and on the railway which pass through the park. 7°57'-8°04'N, 81°03'-81°11'E

Date and History of Establishment Created a national park on 7 August 1984.

Area Covering 17,350ha and lying in the Mahaweli protected areas complex, it links Wasgomuwa National Park (37,063ha) to the south with Somawathiya Chaitiya National Park (37,762ha) to the north.

Land Tenure State

Altitude Ranges from 20m to 60m, with an occasional rock outcrop.

Physical Features The Mahaweli Ganga flows from south to north through the centre of the park. The flood plains of rich alluvial soil flanking the river are characterised by numerous shallow marshy depressions known as 'villus'. The prolonged periods of inundation of these low-lying areas, together with the nutrients carried in by the water, are largely responsible for the exceptionally high level of net primary productivity (Jansen, 1981). In addition to being flooded in the wet season, the villus are also inundated during the dry season because the headwaters of the Mahaweli Ganga experience the south-west monsoon at this time of year. Up until the recent diversion of the Mahaweli Ganga for irrigation purposes, the villus were particularly important as dry season grazing areas (Ishwaran, 1985).

Climate Being in the dry zone, there is only a north-east monsoon from October to late-January. This is followed by a dry season lasting from May to September.

Vegetation Saturated soils and flooding prevent tree growth and enhance the growth of water-tolerant grasses and aquatic plants. The vegetation of the villus shows definite patterns of zonation, with creeping grasses, such as *Cynodon dactylon*, and essentially terrestrial annual plants on the margins; hydrophobic species, such as *Alternanthera sessilis*, *Polygonum* spp., *berudiyani*, *Jussiaea repens*, *kankun*, *Ipomoea aquatica*, *diyahabarala*, *Monochoria hastata* and *Scirpus grossus*, and grasses, such as *gojabba*, *Hygorhiza aristata*, *Brachiaria mutica*, *Echinochloa colonum*, *Paspalum vaginatum*, *Digitaria longiflora* and *Paspalidium* spp., further inwards; floating plants, such as *kekatiya*, *Aponogeton crispum*, *A. natans* and *Nymphoides* sp., occur along with *Nelumbo nucifera* in deeper water; and an association of manel *Nymphaea stellata* and the submerged floating plant *Ceratophyllum demersum* in the deepest water. Common floating forms found in all zones are water lettuce *Pistia stratiotes*, *Salvinia molesta*, *diya nidikumba*, *Neptunia oleracea* and *ikiliya*, *Trapa bispinosa*. The original riverine forest on the levees has been almost completely removed to make way for tobacco fields. Between the levees and the marshes of the villus, the vegetation resembles that of swamp forests, due to periodic inundation, with species such as *kumbuk*, *Terminalia arjuna*, *helamba*, *Mitragyna parvifolia*, *makulu*, *Hydnocarpus venenata*, *mee*, *Madhuca longifolia* and *mudilla*, *Barringtonia asiatica* being the most common. Clumps of rattan (cane) *Calamus rotang* are also common in the area. About 25 plants of a rare herb *Pentapetes phoenicea* are found at three different sites in the swamp forest (M. Jansen, pers. comm., 1985). The vegetation of the flood plains is further described by Scott (1989). Elsewhere, there is monsoon forest on higher ground and gallery forest along river banks.

Fauna The rich vegetation in the villus attracts large numbers of grazing animals and birds and supports a higher annual biomass than any other type of habitat within the Accelerated Mahaweli Development Project area. The flood plains, with their abundant supply of water and grasslands, are an important habitat for elephant *Elephas maximus* (E), as well as providing a corridor for elephants ranging between Somawathiya Chaitiya and Wasgamuwa national parks. Other mammals commonly encountered in the flood plains are fishing cat *Felis viverrina*, jungle cat *F. chaus*, rusty-spotted cat *F. rubiginosus*, jackal *Canis aureus*, wild boar *Sus scrofa*, Indian muntjac *Muntiacus muntjak*, sambar *Cervus unicolor*, spotted deer *C. axis* and water buffalo *Bubalus bubalis* (E). The marshes support a large population of reptiles including natricine water snakes, mugger *Crocodylus palustris* (V) and estuarine crocodile *C. porosus* (E). Important fish species of the villus are climbing perch *Anabas testudineus*, snake heads *Ophiocephalus striatus* and *O. parulius*, freshwater shark *Labeo sp.*, branded etroplus *Etroplus surantensis*, butter catfish *Ompok bimaculatus* and the introduced tilapia *Tilapia mossambica*. The flood plains are particularly important for the diversity and abundance of their avifauna, particularly migrant birds. It is estimated that around 75 species winter in the marshes of the flood plain. Commonly seen migrants are marsh sandpiper *Tringa stagnatilis*, wood sandpiper *T. glareola*, Asiatic golden plover *Pluvialis dominica*, garganey *Anas querquedula*, osprey *Pandion haliaetus* and black-tailed godwit *Limosa limosa*. Common residents are eastern large egret *Egretta alba*, little egret *Egretta garzetta*, cattle egret *Bubulcus ibis*, painted stork *Ibis leucocephalus*, pond heron *Ardeola grayii*, eastern grey heron *Ardea cinerea*, pheasant-tailed jacana *Hydrophasianus chirurgus*, purple coot *Porphyrio porphyrio*, Indian darter *Anhinga rufa*, little cormorant *Phalacrocorax niger*, Indian shag *P. fuscicollis*, Indian cormorant *P. carbo sinensis*, brahmyni kite *Haliastur indus*, painted snipe *Rostratula benghalensis*, black-winged stilt *Himantopus himantopus* and red-wattled lapwing *Vanellus indicus* (M. Jansen, pers. comm., 1985). Further details of the avifauna are given by Scott (1989).

Cultural Heritage There is no special evidence of historical ruins. This section of the Mahaweli Ganga was connected to the ancient irrigation network in the vicinity. On the right bank of the river, at the edge of Mutugalla Villu, are ruins of an ancient cave monastery with inscriptions dating back to between the 2nd and 7th century BC.

Local Human Population Muslim migrants have traditionally cultivated tobacco along the river banks, but at increasingly intense levels. More recently, brick-making has been introduced from the west coast, and in 1987 the Housing Development authority built eight houses in the Manampitiya area of the park for its workers. Other settlements within the park include an army camp and boutiques. Dairy Farming, fishing, and cane extraction also contribute to the local economy (Jansen, 1981; Hoffmann, 1988; R.L.E. Kuruppu, pers. comm., 1990).

Visitors and Visitor Facilities There are no facilities as yet but bungalows and campsites are planned.

Scientific Research and Facilities No information

Conservation Value The park is central to the integrity of the Mahaweli system of protected areas, both for its unique villus and as a corridor for wildlife migration between grazing lands in Wasgomuwa and Somawathiya Chaitiya national parks. It is particularly important for the long-term survival of elephants within the Mahaweli catchment. Together with the adjacent Somawathiya Chaitiya National Park, Flood Plains provides a refuge for a wide variety of resident and migratory waterfowl (Scott, 1989).

Conservation Management There is an overall systems plan for protected areas within the Mahaweli region (NPS, 1986) but, as yet, there is no management plan for Flood Plains National Park. For purposes of management, it is proposed that the northern half of the park is treated as part of Somawathiya Chaitiya National Park and the southern half as part of Wasgomuwa National Park (M. Jansen, pers. comm., 1986).

Management Constraints Dam construction on the Mahaweli Ganga will inevitably decrease water flow and thereby reduce the magnitude and duration of flooding downstream. This dramatic change in the water regime of the villus will transform the rich grasslands into poor quality grazing grounds, which in turn will be detrimental to the wildlife. This has been accepted as an unavoidable consequence of the Accelerated Mahaweli Development Programme.

The park was added to the IUCN/CNPPA Register of Threatened Protected Areas of the World in 1989, in view of its integrity being severely threatened by increasing levels of exploitation of its resources by settlers from far-off townships such as Kuliyaipitiya. Over 200 tobacco plots, each 1.2ha in area, were set up within the park, apparently with the approval of the Department of Wildlife Conservation, and an additional 230 plots have been unofficially established by migrants (Anon., 1985). About 6,000 halmilla saplings are used for fencing the perimeter of each plot, irrigation of plots by an ingenious lifting technique erodes the banks of rivers, and fuelwood is used for curing the tobacco. Brick-making is rampant and also relies on fuelwood resources for baking bricks. Elephants have fallen into the holes created by the hundreds of kilns and died. Thousands of dairy cattle roam the villus (Hoffmann, 1988; C. Santiapillai, pers. comm., 1986). These activities are due to be phased out, or strictly controlled, to enable the ecosystem to recover, but little action has been taken under the Mahaweli Environment Programme to date. Effective management is hampered by political and security problems in the region.

Staff One game ranger (1990)

Budget The park budget is being planned with help from US-AID.

Local Addresses Assistant Director, Flood Plains National Park, Department of Wildlife Conservation, Mahaweli Environment Project, Polonnaruwa New Town, Polonnaruwa District, North Central Province

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Date November 1985, updated September 1990

**GAL OYA NATIONAL PARK, SENANAYAKE SAMUDRA SANCTUARY,
GAL OYA VALLEY NORTH-EAST SANCTUARY AND
GAL OYA VALLEY SOUTH-WEST SANCTUARY**

IUCN Management Category

Gal Oya National Park:	II (National Park)
Senanayake Samudra Sanctuary:	IV (Managed Nature Reserve)
Gal Oya Valley North-East Sanctuary:	IV (Managed Nature Reserve)
Gal Oya Valley South-West Sanctuary:	IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lie in the south-east of the island, in Eastern and Uva provinces. The town of Amparai is adjacent to the eastern extremity of Gal Oya Valley North-East Sanctuary, and Sellaka-Oya is near to Gal Oya Valley South-West Sanctuary. Gal Oya National Park encompasses Senanayake Samudra Sanctuary. 7°01'-7°22'N, 81°20'-81°39'E

Date and History of Establishment The national park and three sanctuaries were all established by the Gal Oya Development Board on 12 February 1954, mainly to protect the catchment area of Senanayake Samudra Reservoir, and handed over to the Department of Wildlife Conservation in 1965. Two tanks (small lakes), Amparai and Konduwatawana, which used to be sanctuaries prior to the region coming under the authority of the Gal Oya Development Board, are now included within Gal Oya Valley North-East Sanctuary. Boundaries of the proposed Nilgala Jungle Corridor, which is intended to link the protected areas complex with Madura Oya National Park to the north-west, were marked out in August-October 1985.

Area	Gal Oya National Park:	25,900ha
	Senanayake Samudra Sanctuary:	9,324ha
	Gal Oya Valley North-East Sanctuary:	12,432ha
	Gal Oya Valley South-West Sanctuary:	15,281ha

The total area of the protected areas complex is 62,936ha. It is proposed to link Gal Oya National Park with Maduru Oya National Park (58,850ha) *via* Nilgala Jungle Corridor (10,360ha).

Land Tenure Gal Oya National Park and Senanayake Samudra Sanctuary are state owned. Some land in Gal Oya Valley North-East and Gal Oya Valley South-West sanctuaries is private, the rest belongs to the state.

Altitude Ranges from about 30m to over 500m. Senanayake Sumadra lies at about 80m. The top of Govindahela, the highest point in the area but outside the protected areas complex, is at 573m.

Physical Features Comprises the catchment of the Senanayake Samudra, a large waterbody with an impressive backdrop of rocky, forested hills. Two general zones can be distinguished. To the east the peneplain is low (30-80m) and broken by a few solitary remnants of erosion and

many smaller (15-30m) bare rocks known as turtle-backs. West of a line passing approximately from Divulana via Inginiyagala to Buddama, the peneplain is higher (150-250m) and clusters of erosion fragments form the dominant relief. Erosion fragments have one or more steep sides of bare rock but most have at least one side with gentle, invariably boulder-strewn, forested slopes. The Gal Oya basin consists of the Gal Oya and three lesser streams which flow eastward. The Gal Oya was dammed at Inginiyagala in 1948 to form Senanayake Samudra, and the other two streams have since been dammed (McKay, 1973). Senanayake Samudra has a maximum depth of 33.5m and a catchment area of about 100,000ha. The water is fresh, with a pH of 6.8 (Scott, 1989). Geologically, the area consists mainly of the Vijayan series, a variety of Lower Palaeozoic gneissic rocks. Soils are predominantly reddish brown, with alluvium along river beds (Panabokke, 1967).

Climate The area falls within the dry zone, and is subject mainly to the influence of the north-east monsoon. Mean annual rainfall for Gal Oya National Park was 1766mm in 1967-1976 (Ishwaran, 1981).

Vegetation About 45% of Gal Oya National Park is forest, 33% savanna, 9% grassland, and 2% chena (forest disturbed by shifting agriculture). The rest (10%) consists of waterbodies. The forest is generally evergreen, of medium stature (30-40m) with a dense closed canopy layer dominated by *Artocarpus* sp., *Berrya cordifolia*, *Euphorbia longana*, *Mangifera zeylanica* and *Diospyros* spp. Shrub and sapling layers comprise *Mallotus repandus*, *Polyalthia* spp. and *Celtis cinnamomea*, among others. The savanna (Sinhalese: talawa), is found mainly in the west. Dominant species of tree are *Terminalia chebula*, *T. bellirica* and *Pterocarpus marsupium*, all of which have products of medicinal importance. Shrubs include *Phyllanthus emblica* and *Ziziphus* sp. The dominant ground vegetation consists of tall, perennial grasses, the commonest of which are *Cymbopogon confertiflorus* and *Imperata cylindrica*. *Themeda* sp. is more patchily distributed. The grassland, which occurs mostly around waterbodies, is entirely secondary. Annuals, such as *Eragrostis* and *Eleusine*, tend to be common on low lying areas which are flooded for long periods annually. In the higher areas, which may not be submerged every year, perennials, such as *Cynodon dactylon* and *Brachiaria* sp., are more common. The reservoir supports relatively few aquatic macrophytes. *Coelosphaerium*, *Microcystis* and *Melosira* are abundant in the phytoplankton (Scott, 1989). A vegetation map of the park has been produced (McKay, 1973) based on aerial photographs taken in 1956 and published by the Ceylon Survey Department (Scale 1: 31680). More recent material is available.

Fauna A total of 32 species of terrestrial mammals has been recorded in the Gai Oya region (McKay, 1973). The most prominent species are common langur *Presbytis entellus*, endemic toque macaque *Macaca sinica*, leopard *Panthera pardus* (T), sloth bear *Melursus ursinus* (I), elephant *Elephas maximus* (E), wild boar *Sus scrofa*, three species of deer and water buffalo *Bubalus bubalis* (E). The size of the elephant population, estimated at 260-300 animals including adult males (McKay, 1973), has probably remained much the same over the last ten years, although in Gal Oya Valley North-East Sanctuary numbers may have decreased by about 160 (Vancuylenberg, 1974) to just under 100 elephants (Ishwaran, 1981).

Of the more than 300 species of birds which occur regularly in Sri Lanka, 150 have been observed in the Gal Oya region (McKay, 1973). Particularly noteworthy is red-faced malkoha *Phoenicophaeus pyrrhocephalus*, endemic to Sri Lanka and South India, and endemic Sri Lanka spurfowl *Galloperdix bicalcarata* (Atapattu and Wickremasinghe, 1974). The endemic painted francolin *Francolinus pictus* ssp., for which this area is the last refuge (T.W. Hoffmann, pers.

comm., 1989), and brown-capped babbler *Pellorneum fuscicapillum* are also present. Two ecological categories of birds deserve mention. First are the large numbers of fish-eating birds which occur in and around the tanks. Besides the numerous pelicans (notably *Pelecanus philippensis*), cormorants (three species), herons and fishing eagles (*Ichthyophaga ichthyaetus* and *Haliaeetus leucogaster*), there are large numbers of Brahminy kites *Haliastur indus* around Senanayake Samudra and the occasional migrant osprey *Pandion haliaetus*. The second group consists of frugivorous birds, such as hornbills *Tockus griseus* and *Anthraceroceros coronatus*, pigeons *Ducula aenea* and *Treron* spp., parrots *Psittacula* spp. and *Loriculus beryllinus*, and barbets *Megalaima* spp.

Among the reptiles present, mugger *Crocodylus palustris* (V) is locally common in tanks and irrigation ditches and common monitor *Varanus bengalensis* is abundant in drier areas. Rat snakes *Ptyas mucosus*, python *Python molurus* (V) and the venomous snakes *Naja naja* and *Vipera russelli* are common. Several species of gekko are present and agamids *Calotes* spp. and skink *Mabuya* sp. are abundant. Freshwater turtles *Melanochelys trijuga* and *Lissemys punctata* are numerous in irrigation canals, and star tortoise *Testudo elegans* is present. Amphibians include *Bufo melanostictis*, *Rana tigrina*, *R. limnocharis*, *R. gracilis* and *Rhacophorus cruciger* (McKay, 1973). Freshwater fish include mainly *Wallago attu valleya*, and introduced carps (Cyprinidae), gouramis (Belontiidae) and *Tilapia mossambica*. Of the invertebrate fauna, only those forms of particular importance to the elephant, such as termites and biting arthropods, are mentioned by McKay.

Cultural Heritage Gal Oya is the only valley in Sri Lanka which can claim to have given shelter to Sinhala kings in three different locations; namely to King Tissa at Digha Vapi in the 2nd century BC, to King Buvanekabahu on the summit of Govindahela in the 13th century, and to the self-proclaimed King Dore Swamy at Nilgala in the 19th century. The Digha Vapi Dagoba, built in the 2nd century BC to mark the spot where the Lord Buddha is supposed to have sat during his last visit to Sri Lanka, attracts thousands of pilgrims (Szechowycz, 1958). The hilly country in the west was one of the last strongholds of the Veddas. Henebedde Cave near Vadinagala has a drip ledge and contains a Brahmin inscription (Hoffmann, 1978). Near the cave are a moonstone, guardstone and balustrade stone. Ruins of an ancient structure are close by.

Local Human Population The park is uninhabited, the small settlement of aboriginal Veddas on the northern boundary having been evacuated. Some 2,000 villagers lived in the neighbouring Gal Oya South-West Sanctuary in 1954; subsequent efforts by the authorities to resettle them have so far failed. The valley area below the reservoir has been developed intensively for agricultural purposes under the Gal Oya Development Scheme begun in 1949.

Visitors and Visitor Facilities The park is largely undeveloped for tourism. Accommodation is not available within any of the protected areas, but there is a Wildlife Department bungalow at Engal Aru and rest houses are available outside the park at Inginiyagala and Amparai. Boats can be hired on Senanayake Samudra.

Scientific Research and Facilities Extensive research was conducted in 1967-1969 (McKay, 1973) as part of an elephant study programme organised by the Smithsonian Institute. Subsequent work has also been focused on the elephant population (Vancuylenberg, 1977; Ishwaran, 1981, 1983). There are no research facilities.

Conservation Value The park was established to protect the catchment area of the Senanayake Samudra, constructed as part of a development scheme to open up some 162,000ha of forest for agricultural and industrial purposes. It is considered to be among the most scenically beautiful landscapes in Sri Lanka (Hoffmann, 1973). Senanayake Samudra supports an important fishery, with fish production estimated at 873 metric tonnes per year, and is a valuable source of water for irrigation (Scott, 1989).

Conservation Management The park is buffered by sanctuaries on all but its western boundary. Nilgala Jungle Corridor in the north-west is planned to provide a route for elephants moving between Gal Oya and Maduru Oya national parks. Similarly, in the south, a corridor for elephants is proposed, to link Gal Oya and Yala East national parks *via* Lahugala-Kitulana National Park. These corridors were planned some ten years back but no progress has been made in recent years.

Management Constraints Subsistence hunting, collection of food, medicinal products and fuelwood from the forests and cattle grazing are traditional activities of the local people. Burning of grasslands to improve pastures for cattle, illicit gemming along water bodies, collection of rattan and poaching are particular problems. Inadequate protection of the catchment area from settlement and gemming has led to massive erosion and siltation of the Senanayake Samudra (Department of Wildlife Conservation, pers. comm., 1990). A joint venture between the Department of Wildlife Conservation and a private company (Tiger Tops Jungle Lodge) to construct a 50-bed safari lodge in the park (Atapattu and Wickremasinghe, 1974) was approved by the Cabinet, but subsequently shelved following objection by the Wildlife and Nature Protection Society (Fernando, 1983).

Staff Park warden with a staff of 41, including 4 game rangers (1985)

Budget No information

Local Addresses Park Warden, Gal Oya National Park, IDQ 2, Inginiyagala, Amparai

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Date May 1986, updated September 1990

GIANT'S TANK SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Situated on the coastal plain of north-western Sri Lanka, about 5km from the sea near Murukkan, 18km south-east of Mannar, Mannar District, Northern Province. 8°52'N, 80°02'E

Date and History of Establishment Declared a sanctuary on 24 September 1954.

Area 3,941ha

Land Tenure The tank is state owned; surrounding areas are partly state owned and partly private.

Altitude Less than 25m

Physical Features The sanctuary includes an ancient tank (water storage reservoir), now heavily silted. The tank is fed by an ancient canal, recently restored, which carries water from Malwatu Oya River (Aruvi Aru). It has a catchment area of 9,850 ha, a maximum depth of 3.2m, and a pH of 7.5. The water level fluctuates widely according to irrigation needs and monsoon rainfall.

Climate Conditions are tropical monsoonal with mean annual rainfall of 1051mm and mean annual temperature of 27.8°C.

Vegetation The tank is surrounded by rice paddies and dry scrub forest. There are few aquatic macrophytes; the phytoplankton includes *Oscillatoria*, *Microcystis* and *Hyella*.

Fauna Elephant *Elephas maximus* (E) occurs in the vicinity of the tank. Details of the avifauna are limited. An estimated 11,000 ducks were present in 1965, including 1,000 cotton pygmy goose *Nettapus coromandelianus*. In February 1984, 1,800 wigeon *Anas penelope* and 1,100 garganey *A. querquedula* were recorded. Comb duck *Sarkidiornis melanotos* has been reported.

Commercially important fishes include *Labeo dussumieri*, *Puntius sarana* (abundant), *Puntitius dorsalis*, *Ompok bimaculatus*, *Heteropneustes fossilis*, *Tilapia mossambica* and *Ophicephalus striatus*.

Cultural Heritage No information

Local Human Population The tank is used for fishing, as a domestic water supply and for irrigation. It supports an important fishery; production is estimated at about 200 metric tonnes per year.

Visitors and Visitor Facilities No information

Scientific Research and Facilities Some studies have been carried out at the tank, mainly on the fisheries.

Conservation Value The tank is known to be important for a variety of waterfowl and shorebirds.

Conservation Management No information

Management Constraints Siltation, due to forest clearance in surrounding areas, and eutrophication are the main problems.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date September 1990

HAKGALA STRICT NATURAL RESERVE

IUCN Management Category I (Strict Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies 6km south-east of Nuwara Eliya in Central and Uva provinces. 6°53'-6°57'N, 80°46'-80°50'E

Date and History of Establishment Designated a strict natural reserve on 25 February 1938. The adjacent botanical gardens were founded in 1860.

Area 1,142ha. Contiguous to Hakgala Botanical Gardens

Land Tenure State

Altitude Ranges from about 1,650m to 2,178m, at the top of Hakgala Peak.

Physical Features The reserve lies on the south bank of the Sita-Eliya and consists almost entirely of the Hakgala massif with its three prominent peaks, among the highest in the country. These are said to resemble the jaw of an elephant, hence the Sinhalese name hak (jaw) and gala (rock) (Alex Sylva, 1986). Soils are red-yellow podzols.

Climate Mean annual rainfall is 2400mm. Rain falls on 211 days of the year (Meijer, 1980/1981).

Vegetation Consists of botanically-rich montane cloud forest which is noted for its endemic archaic Monimiaceae *Hortonia floribunda* and abundance of orchids. Common species are keena *Calophyllum walkeri*, *Syzygium irotundifolium* and *Elaeocarpus montanus*. The undergrowth consists of various species of niloo *Strobilanthes*. Two forest types have been described: dwarf forest, characterised by low-growing species such as *Osbeckia buxifolia*; and a taller forest (10-20m), comprising *Rhododendron zeylanicum* and *Actinodaphne speciosa* (Meijer, 1980/1981).

Fauna Mammals include a variety of endemics such as purple-faced langur *Presbytis senex*, toque macaque *Macaca sinica*, Sri Lanka spiny rat *Coelomys mayori*, Sri Lanka bi-coloured rat *Srilakmys ohiensis*, Kelaart's long-tailed shrew *Feroculus feroculus*, Sri Lanka long-tailed shrew *Crocidura miya* and Pearson's long-clawed shrew *Solisorex pearsoni* (M. Jansen, pers. comm., 1986). Other mammals include leopard *Panthera pardus* (T), fishing cat *Felis viverrina*, wild boar *Sus scrofa*, sambar *Cervus unicolor*, highland flying squirrel *Ratufa macroura*, large Sri Lanka flying squirrel *Petaurista petaurista* and grizzled pipistrel *Pipistrellus mordax*. Elephant *Elephas maximus* (E) was still present in 1939 (Werner, 1988).

Amphibian species include endemics such as *Bufo kelaarti*, *Rhacophorus cruciger*, *R. microtypanum*, *Philautus schmardanus*, *Ramanella palmata* and *Microhyla zeylanica*, along with *Rana limnocharis* and *Hylarana temporalis*. Among the noteworthy reptiles are the following endemics: *Uropeltis melanogaster*, *Rhinophis blythi*, *Aspidura brachyorrhas*, *A. trachyprocta*, viper *Hypnale nepa*, geckos such as *Calotes nigrilabris*, *Cophotis ceylanica* and *Ceratophora stoddarti*, and skinks such as *Sphenomorphus striatopunctatus* (M. Jansen, pers. comm., 1986).

The avifauna is varied and of high endemism. Noteworthy species include mountain hawk eagle *Spizaetus nipalensis*, endemic junglefowl *Gallus lafayettei*, wood pigeon *Columba torringtoni*, highland nightjar *Caprimulgus indicus*, endemic blue magpie *Kitta ornata*, endemic yellow-eared bulbul *Pycnonotus penicillatus*, endemic brown-capped babbler *Pellorneum fuscocapillum*, endemic rufous babbler *Turdoides rufescens*, endemic dusky-blue flycatcher *Muscicapa sordida*, endemic Sri Lanka warbler *Bradypterus palliseri*, endemic Sri Lanka arrenga *Myiophonus blighi*, spotted-winged thrush *Zoothera spiloptera*, blackbird *Turdus merula* and endemic hill white-eye *Zosterops ceylonensis*. Commoner birds include orange minivet *Pericrocotus flammeus*, small minivet *P. cinnamomeus*, black bulbul *Hypsipetes madagascariensis*, common scimitar babbler *Pomatorhinus horsfieldii*, grey-headed flycatcher *Culicicapa ceylonensis*, pied bush chat *Saxicola caprata* and scaly thrush *Zoothera dauma*. A large number

of migrant bird species visit the area, of which the most interesting include India pitta *Pitta brachyura*, brown flycatcher *Muscicapa tatirostris*, Kashmir red-breasted flycatcher *M. subrubra*, Indian blue chat *Erithacus brunneus*, pied ground thrush *Zoothera wardii*, hill munia *Lonchura kelaarti* and large-billed warbler *Phylloscopus magirostris* (M. Jansen, pers. comm., 1986).

Cultural Heritage Many prominent peaks are sites of Hindu worship. The nearby Sita Eliya, a Hindu temple, on the main Nuwara Eliya-Welimada road, has a tradition which goes back to the legend of Rama and Sita, the 'Ramayana' (Alex Sylva, 1986).

Local Human Population The reserve was uninhabited, but huts and houses have been built by encroachers (T.W. Hoffmann, pers. comm., 1989).

Visitors and Visitor Facilities There is a well-maintained trail to the summit, but no other facilities. There is a circuit bungalow belonging to the Department of Agriculture inside the botanical gardens. Hotel accommodation is available at Nuwara Eliya.

Scientific Research and Facilities Scientific facilities are available at the botanical gardens.

Conservation Value Hakgala is an important but isolated reserve for cloud forest, which supports a diverse fauna including a number of endemics. Its small size and isolation, however, jeopardise its long-term viability.

Conservation Management The Department of Wildlife Conservation is in the process of evicting encroachers.

Management Constraints Illicit felling by vegetable farmers (J. Banks, pers. comm., 1986; Werner, 1988a) and die-back of the cloud forest (Werner, 1988b) are threatening the existence of this small reserve. Restriction on entry to the reserve from the botanical gardens is not enforced.

Staff Five (1985)

Budget No information

Local Addresses Park Warden, Horton Plains National Park, Ohiya, via Haputala

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Date April 1986, updated September 1988

HIKKADUWA MARINE SANCTUARY, INCLUDING ROCKY ISLETS (AMBALANGODA) SANCTUARY

IUCN Management Category

Hikkaduwa Marine Sanctuary:	IV (Managed Nature Reserve)
Rocky Islets Sanctuary:	IV (Managed Nature Reserve)

Biogeographical Province 4.02.01 (Ceylonese Monsoon Forest)

Geographical Location Lies on the south-west coast in Southern Province, approximately 65km south of Colombo and north of Galle. The marine sanctuary is located at 6°08'N, 80°05'E and Rocky Islets Sanctuary at 6°09'N, 80°08'E.

Date and History of Establishment Created a marine sanctuary on 18 May 1979 (Gazette No. 37). The boundaries are based on those of a previous 'Fishery Protected' area declared under Section 26 of the Fisheries Ordinance on 3 March 1961 (Gazette No. 12304). Rocky Islets was previously declared a sanctuary on 25 October 1940 (Gazette No. 8675). The first steps towards establishing the area as a marine park have been taken by the National Aquatic Resources Agency (UNEP/IUCN, 1988). Protection is partial: whereas removal of coral, sand or other substance from the area is prohibited under the Crown Lands Ordinance, Sections 63 and 66 (Salm, 1975a), fish are not legally protected. The terrestrial parts of Rocky Islets Sanctuary are protected under the Fauna and Flora Protection Ordinance, Gazette No. 8675.

Area 45ha, including Rocky Islets Sanctuary (1.2ha)

Land Tenure State

Altitude Sea level

Physical Features The reef at Hikkaduwa extends about 130m seawards before dropping sharply to soft substrate at 7-10m. In the north the reef is separated from the shore by a 3-4m deep channel, whereas in the south the reef flat abuts directly onto the shore. Spur and groove formations are found on the seaward face of the reef, particularly in the southern part. Rocky Islets comprises a small cluster of rocks several hundred metres offshore. Just beyond Rocky Islets and at a depth of about 20m is a series of sandstone reefs, scattered with occasional coral colonies and gorgonians (Mergner and Scheer, 1974). Further details of the reef structure are given in UNEP/IUCN (1988).

Climate No information

Vegetation Rocky Islets is devoid of vegetation. Inshore, reefs feature a narrow band of seagrass before a *Halimeda* zone. On seaward slopes, the algae *Halimeda* and *Caulerpa* may be common (UNEP/IUCN, 1988).

Fauna A full description of the coral fauna is given in UNEP/IUCN (1988). Coral reefs in the lee of Rocky Islets were still intact and flourishing in 1981; others were in less good condition (Jonklaas, 1981). The islets used to be an important roost for seabirds until the number of visiting holiday-makers increased. Fish are abundant and include a wide variety of reef species, with 68 recorded to date (De Silva and Rajasuriya, 1985).

Cultural Heritage None

Local Human Population Rocky Islets is uninhabited but the coastal area is heavily populated as the reef lies off the holiday resort of Hikkaduwa.

Visitors and Visitor Facilities The area receives numerous visitors as Hikkaduwa is a major tourist resort with about 150 hotels along the sea front. There are at least three dive operators (Hughes, 1985), organised boat tours, and excursions in glass-bottom boats (Jonklaas, 1981).

Scientific Research and Facilities These are the only reefs in Sri Lanka which have received detailed biological study (Mergner and Scheer, 1974), and in 1985 they were surveyed by the National Aquatic Resources Agency. They were once visited by a student cruise ship (Jonklaas, 1981), but educational use of the reefs has since lapsed (R.D.A. Burge, pers. comm., 1986).

Conservation Value Hikkaduwa is of high scientific and recreational value. Rocky Islets was originally protected for its seabird colonies (De Silva and Rajasuriya, 1985).

Conservation Management There is no management plan, but it has been recommended that the area should be managed as a marine park, rather than sanctuary, with two zones for general use, one of which would cover Rocky Islets Sanctuary, and one for research (De Silva and Rajasuriya, 1985). Other recommendations are made by Jonklaas (1981).

The sanctuary is not protected. Its boundaries were once demarcated by two buoys but these were swept away and have not been replaced since 1966 (De Silva and Rajasuriya, 1985). Supervision of the sanctuary should be the responsibility of the village council under the Department of Wildlife Conservation but there is currently no wardening (S.M. Wells, pers. comm., 1986). A sign in the grounds of the Coral Gardens Hotel indicates that spearfishing, and coral and shell collecting are prohibited. In early 1986, some fishermen using dynamite were apprehended as a result of action taken by one of the commercial diving operators. The reserve is mentioned in tourist leaflets but otherwise is not publicised (Hughes, 1985).

Management Constraints Reefs in the lee of Rocky Islets Sanctuary were intact and flourishing in 1981, but there was some damage from recreational activities (Jonklaas, 1981). Fish collecting was taking place in the 1970s and Salm (1975b) noted a paucity of small, colourful reef fish of the type caught extensively for the aquarium trade. Visitor impact on the reefs may not be severe but damage to corals by breakage is evident (Hughes, 1985). Coral is damaged by boats, through anchoring and pollution in the reef lagoon. Damage to coral has also been recorded adjacent to a freshwater outlet polluted by coconut husk retting (De Silva and Rajasuriya, 1985). The reefs have apparently been stripped of shells; local shops, hotels and people sell both shells and corals (Jonklaas, 1981) although corals no longer seem to be sold on the beach (S.M. Wells, pers. comm., 1986); spiny lobster has also been overcollected by glass-bottom boat operators for sale to customers on board (De Silva, 1985). Spearfishing is common (Hughes, 1985) and the larger territorial fish are said to be scarce (Jonklaas, 1981).

Seabirds no longer visit Rocky Islets Sanctuary due to excessive numbers of visitors. Coral quarrying is extensive in the region and many of the buildings use crushed corals as hard standing (Hughes, 1985); erosion of the coast is becoming a serious problem.

Staff None

Budget No information

Local Addresses None

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Date May 1986, updated December 1988

HORTON PLAINS NATIONAL PARK

IUCN Management Category II (National Park)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies about 32km south of Nuwara Eliya in the Central Highlands of Central Province. 6°47'-6°50'N, 80°46'-80°50'E

Date and History of Establishment Upgraded to national park status on 16 March 1988, having previously been created a nature reserve on 5 December 1969. Like other catchments in the hills, the area had previously received some protection under an administrative order issued in 1873, which prohibited clearing and felling of forests above 5,000 ft (1,524m). This was based on the advice of the botanist Sir Joseph Hooker, who urged the then Colonial Government "to leave all Montane Forests above 5000 ft. undisturbed" (Wijewansa, 1983). The place is

named after Sir Robert Horton, a former British Governor, who travelled to the area to meet the Ratemahatmaya of Sabaragamuwa Province in about 1836 (Anderson, 1982).

Area 3,160ha. Adjoins the eastern edge of Peak Wilderness Sanctuary (22,380ha).

Land Tenure State

Altitude Ranges from about 1,800m to 2,389m at the top of Kirigalpota. The plateau, at 2,100m, is the highest tableland in Sri Lanka.

Physical Features Horton Plains comprises a gently undulating highland plateau at the southern end of the central mountain massif of Sri Lanka. It is dominated to the north by Mount Totupolakanda (2,357m) and to the west by Mount Kirigalpota (2,389m), Sri Lanka's third and second largest peaks, respectively. Tributaries of three major rivers originate from within the reserve, the Mahaweli Ganga flowing to the north, the Kaleni Ganga to the west and Walawe to the south. Belihul Oya, a small stream feeding the Walawe, tumbles over a cliff as a large and spectacular waterfall. Rocks are of Archaean age, belonging to the high series of the pre-Cambrian, and include khondalites (metasediments) and chamokites. They have been subject to folding and plication on a vast scale in pre-Cambrian times (Jayasekera, 1970). The red-yellow podzols are characterised by a thick, black, organic layer at the surface (Wijewansa, 1983).

Climate Annual rainfall in the region is about 2540mm (Wijewansa, 1983), but for Horton Plains may exceed 5000mm (Ratnayake and Balasubramaniam, 1989). Rain occurs throughout most of the year but there is a dry season from January to March. Temperatures are low, with an annual mean temperature of 13°C, and ground frost is common in February (Silva, 1982).

Vegetation The plateau supports grassland fringed and interspersed with patches of dense montane cloud forest. The forest canopy grows to about 20m and is dominated by the endemic keena *Calophyllum walkeri*, in association with varieties of Myrtaceae (*Syzygium rotundifolium* and *S. sclerophyllum*) and Lauraceae (*Litsea*, *Cinnamomum* and *Actinodaphne speciosa*). *Strobilanthes* spp. (Acanthaceae) dominate the undergrowth, except when in competition with dwarf bamboo (*Indocalamus* and *Ochlandra* spp.). The dense nature of *Strobilanthes* vegetation inhibits the development of a herb layer. *Rhodomyrtus tomentosa* bushes characteristically grow along the forest margins and near the summits of mountains. 'Patnas' or plains vegetation occurs above 1,500m. Tussock grasses, such as *Chrysopogon zeylanicus* and *Cymbopogon confertiflorus*, predominate except in damp hollows where pure stands of *Chimonobambusa* (*Arundinaria*) *densifolia* have developed. A rich herbaceous flora flourishes on the patnas with numerous species of both temperate (e.g. *Ranunculus*, *Pedicularis*, *Senecio*, *Gentiana* and *Alchemilla*) and tropical (e.g. *Eriocaulon* and the rare endemic daffodil orchid *Ipsea speciosa*) origin. *Gordonia* sp. and *Rhododendron arboreum*, now common on the plateau, have spread to Sri Lanka via the mountains of southern India from the Himalayas (Werner and Schweinfurth, 1985). Ratnayake and Balasubramaniam (1989) have recorded 54 woody species, of which 27 (50%) are endemic to Sri Lanka, 21 (39%) are restricted to the forests of South India and Sri Lanka, and the remaining six species (11%) are ubiquitous to the forests of South-East Asia. The cloud forest features a number of wild relatives of cultivated plants, such as pepper, guava, tobacco and cardamon.

The origin of the montane grasslands has long been debated (Chambers, 1980), some workers (Pearson, 1899; Holmes, 1951; Werner, 1982; Wijewansa, 1983) opining that the grasslands are

an artificial community created by forest clearance and maintained by burning, while others (Szechowycz, 1954; Rosayro, 1961; Hoffmann, 1987) consider them to be the natural vegetation of these uplands. Such opposing views are to some extent reconciled by Perera (1969) who maintains that the grasslands comprise several communities, those of dry slopes having been created by forest clearance and maintained by burning and grazing, and those of depressions being natural communities where conditions are too wet to allow the development of forest. Frost and soil erosion may be additional limiting factors (Werner, 1982).

Fauna Elephant *Elephas maximus* (E) disappeared from the region some 50 years ago, or earlier. Mammals which still occur in reasonable numbers include Kelaart's long-clawed shrew *Feroculus feroculus* (a monotypic genus endemic to the montane regions of Sri Lanka), slender loris *Loris tardigradus* (absent from neighbouring Peak Wilderness Sanctuary), endemic toque macaque *Macaca sinica*, purple-faced langur *Presbytis vetulus*, rusty-spotted cat *Felis rubiginosus*, fishing cat *F. viverrinus*, leopard *Panthera pardus* (T) (estimated at 30 individuals), wild boar *Sus scrofa*, otter *Lutra lutra*, stripe-necked mongoose *Herpestes vitticollis*, Indian spotted chevrotain *Tragulus meminna*, Indian muntjac *Muntiacus muntjak*, sambar *Cervus unicolor* and long-tailed giant squirrel *Ratufa macroura* (Werner and Schweinfurth, 1985; Wilson, 1988).

The contiguous areas of Peak Wilderness Sanctuary and Horton Plains National Park contain all 21 bird species endemic to Sri Lanka, of which the following are recorded only for Horton Plains: Sri Lanka blue magpie *Kitta ornata*, dusky blue flycatcher *Muscicapa sordida*, Sri Lanka white-eye *Zosterops ceylonensis* and Sri Lanka wood pigeon *Columba torringtoni* (Werner and Schweinfurth, 1985). Other endemics include Sri Lanka spurfowl *Galloperdix bicalcarata*, Sri Lanka junglefowl *Gallus lafayettei*, yellow-fronted barbet *Pycnonotus penicillatus*, rufous babbler *Turoides rufescens*, Palliser's warbler *Bradypterus palliseri* and Bligh's whistling thrush *Myiophoneus blighi* (J.D.N. Banks, pers. comm., 1986). Numerous birds overwinter in the highlands, migrating from Europe and northern Asia. Swiftlet *Collocalia* sp. and Alpine swift can be seen circling over the patnas, as can various raptors such as crested serpent eagle *Spilornis cheela* and mountain hawk eagle *Spizaetus nipalensis*, black-winged kite *Elanus caeruleus*, peregrine *Falco peregrinus*, and various species of harriers and buzzards.

Among reptiles are snake *Aspidura brachyorrhos* and the widespread agamid *Calotes nigrilabris*.

The only fish is the introduced rainbow trout *Salmo gairdneri*. The distribution of the endemic freshwater shrimp *Caridina singhalensis* is believed to be confined to a 10km stretch of river within the park (Silva, 1982).

Cultural Heritage Stone tools dating back to the Balangoda culture of prehistoric times have been found in the area. The Sinhalese settled in the lowlands up to an altitude of 700m, sometimes frequenting higher altitudes to dig for gems or iron ore, graze cattle, construct irrigation canals and fell trees for timber. Several patnas existed at that time in regions above 1,800m (W. Baker, cited in Werner, 1982).

Local Human Population None

Visitors and Visitor Facilities Accommodation is available at Ginihiriya (Anderson) Lodge and Farr Inn (an old hunting lodge built by Thomas Farr early this century and now run by the

Ceylon Hotels Corporation), and there is a rest house belonging to the Department of Wildlife Conservation. Camping and fishing is allowed on a permit basis.

Scientific Research and Facilities Faunal studies include research on purple-faced langur (Rudran, 1979) and freshwater shrimp (Silva, 1982). The structure of the vegetation and die-back phenomenon has been examined by Werner (1988) and Ratnayeke and Balasubramaniam (1989).

Conservation Value Horton Plains, its surrounding forests and the adjoining Peak Wilderness, constitute Sri Lanka's most important catchment area. The plains are also of outstanding scenic beauty and conservation importance, containing most of the habitats and endemic plants and animals representative of the country's wet and montane zones (Hoffmann, 1987). The western slopes support the most extensive area of montane cloud forest surviving in the country (Werner and Schweinfurth, 1985).

Conservation Management Horton Plains formed part of a large system of similar plains and dense forest including the Bopats, Agrapatnas, and Moon and Elk plains, which were discovered by British residents at the beginning of the last century. Between 1831 and independence in 1948, Horton Plains became hunting grounds for sambar and, to a lesser extent, elephant and wild boar. During this time the lower slopes were gradually cleared and converted to coffee and subsequently tea plantations; Horton Plains and Peak Wilderness are now isolated by a contiguous belt of plantations and settlements. In the late 1960s the Department of Agriculture established an extensive seed potato farm. About half of the open plains were under potato cultivation by 1977, when the farm was closed down. Potato fields have since reverted to grassland but former land use practices remain evident (Hoffmann, 1987). Following the recent upgrading of Horton Plains to national park status, there are plans to re-introduce the elephant (Wilson, 1988).

Management Constraints A fairly recent phenomenon, first observed in Totupolakanda and reported by Perera (1978), is the dying of the cloud forest on all peripheral aspects of the plateau (Ratnayeke and Balasubramaniam, 1989). This has reached serious proportions, with a 50% reduction of forest cover in some places (Hoffmann, 1988a). Water deficit is believed to be the main cause of the die-back, droughts having become noticeably more frequent during the last few decades. Regeneration of cloud forest is impeded by frost, which may be becoming increasingly more severe (Werner, 1988; Ratnayeke and Balasubramaniam, 1989). Other problems include increasing disturbance from visitors, poaching deer for meat, increased gemming around Governor's Pool, annual fires caused by miscreants and localised spread of introduced exotics such as black wattle *Acacia mollissima* (Hoffmann, 1987, 1988a; Wilson, 1988).

Staff One park warden, one deputy park warden, two wildlife range assistants, eight wildlife guards and ten ancillary staff, housed since the 1970s in the old potato plantation workers buildings.

Budget No information

Local Addresses Park Warden, Horton Plains National Park, Ohiya, via Haputala

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Date May 1986, updated September 1990

HURULU FOREST RESERVE

IUCN Management Category VIII and IX (Multiple Use Management Area and Biosphere Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies within Hurulu Forest between mile posts 120 and 122, along the Trincomalee-Colombo main road in North Central Province. 08°05'-08°20'N, 80°47'-80°55'E

Date and History of Establishment Part of the forest reserve was declared a biosphere reserve in January 1977.

Area The 512ha biosphere reserve is surrounded by some 25,500ha of forest reserve.

Land Tenure State

Altitude Ranges from 90m to 150m.

Physical Features The terrain of the forest reserve is flat to gently undulating and forms a long, shallow basin between discontinuous parallel ridges to the east and west. Main rock types are crystalline limestones, quartzites and charnockites. The whole of the central basin is drained by the Alut Oya, Halmilla Oya and Gal Oya (M. Jansen, pers. comm., 1986).

Climate Mean annual rainfall is 1600mm. Mean annual temperature is 27.3°C.

Vegetation The forest reserve contains tropical dry evergreen forest, with a typically layered structure comprising an upper canopy of moderately large trees, a sub-canopy and a distinct herb layer. The upper canopy is comparatively dense, about 15-20m in height and interrupted at intervals by emergents, of which satin *Chloroxylon swietenia* and palu *Manilkara hexandra* are typical. Other common species are wira *Hemicyclia sepiaria*, which comprises about 30% of the trees in the forest, ebony *Diospyros ebenum*, penela *Sapindus emarginatus*, kuma *Glenica unijuga*, welang *Pterospermum canescens*, milla *Vitex pinnata* and halmilla *Berrya cordifolia*. The sub-canopy is characterised by species such as korakaha *Memecyclon* spp., kunumella *Diospyros ovalifolia* and weliwenna *Dimorphocalyx glabellus* (M. Jansen, pers. comm. 1986). Some 17 shrub species have been identified, together with 41 herbaceous species, of which the orchid *Dendrobium maccarthiae* is noteworthy.

Fauna Mammals include pygmy white-toothed shrew *Suncus etruscus*, common langur *Presbytis entellus*, endemic toque macaque *Macaca sinica*, loris *Loris tardigradus*, sloth bear *Melursus ursinus* (I), jackal *Canis aureus*, rusty-spotted cat *Felis rubiginosus*, Indian fishing cat *F. viverrina*, Indian grey mongoose *Herpestes edwardsi*, Indian brown mongoose *H. fuscus*, ruddy mongoose *H. smithi*, leopard *Panthera pardus* (T), elephant *Elephas maximus* (E), water buffalo *Bubalus bubalis* (E), wild boar *Sus scrofa*, Indian muntjac *Muntiacus muntjak*, sambar *Cervus unicolor*, spotted deer *C. axis*, porcupine *Hystrix indica*, pangolin *Manis crassicaudata*, black-naped hare *Lepus nigricollis* and bandicoot rat *Bandicota* sp. (M. Jansen, pers. comm., 1986).

The avifauna includes mainly forest species such as endemic Sri Lanka junglefowl *Gallus lafayettei*, rare rufous woodpecker *Micropternus brachyurus*, endemic spurfowl *Galloperdix bicalcarata*, blue-faced malkoha *Rhopodytes viridirostris*, raquet-tailed drongo *Dicrurus paradiseus*, grey hornbill *Tockus griseus* and Malabar pied hornbill *Anthracerus coronatus* (M. Jansen, pers. comm., 1986).

Cultural Heritage No information

Local Human Population The reserve is uninhabited.

Visitors and Visitor Facilities No information

Scientific Research and Facilities No information

Conservation Value The forest fauna includes a variety of endemic birds.

Conservation Management The site is partially protected under the provisions of the Forest Ordinance. The forest reserve surrounding the biosphere reserve acts as a buffer zone. About 3,000ha of the forest reserve has been replanted with exotic teak *Tectona grandis* and *Eucalyptus camaludensis* and the indigenous margosa *Azadirachta indica* (M. Jansen, pers. comm., 1986).

Management Constraints Areas within the reserve have been logged and are subject to chena (shifting cultivation).

Staff No information

Budget No information

Local Addresses Divisional Forest Officer, North Central Division, Trincomalee

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Date August 1986, updated December 1988

KALAMETIYA KALAPUWA SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.02.01 (Ceylonese Rainforest)

Geographical Location Lies on the south coast, about 20km west of Hambantota, Hambantota District, Southern Province. 6°05'-6°06'N, 80°56'-80°59'E

Date and History of Establishment Renotified a sanctuary on 28 June 1984 after a prolonged campaign by conservation bodies, having originally been declared a sanctuary in 1940 and subsequently de-notified in 1946 because of opposition from local people.

Area 712ha

Land Tenure The lagoons are state owned; surrounding areas are partly state owned and partly private.

Altitude Sea level

Physical Features The wetland comprises two coastal lagoons west of the mouth of the Walawe Ganga. Lunama Kalapuwa is a brackish lagoon with extensive mangrove swamps; Kalametiya Kalapuwa is a permanent, slightly brackish lagoon with abundant aquatic vegetation and a mangrove fringe. Both are fed by several small streams, and have maximum depths of 2-3m.

Climate Conditions are tropical monsoonal.

Vegetation Includes mangrove swamps at both lagoons, and reed beds and abundant submerged aquatic vegetation at Kalametiya Kalapuwa. The mangrove vegetation at Kalametiya is in good condition, with a full range of successional stages. There are rice paddies, other cultivated land, grassland, scrub and coconut plantations in surrounding areas.

Fauna Kalametiya Kalapuwa supports breeding colonies of pelicans, herons, egrets, and open-billed stork *Anastomus oscitans*, and large wintering populations of migratory ducks and shorebirds. It is the only place in Sri Lanka where glossy ibis *Plegadis falcinellus* has been regularly reported in recent years. A flock of 26 was observed in 1982, and smaller numbers have been reported on several occasions since then. Some 5,000 ducks were recorded in January 1983, but few were present in the following year, presumably because of heavy hunting pressure. Waterfowl recorded during mid-winter censuses in 1986, 1987 and 1988 included 560 herons and egrets of nine species (mainly cattle egret *Bubulcus ibis* and little egret *Egretta garzetta*) and 2,000 garganey *Anas querquedula*, 1,000 American golden plover *Pluvialis dominica* and 1,000 Mongolian plover *Charadrius mongolus*. At least 17 other species of migratory shorebirds have been recorded in small numbers.

Lunama Kalapuwa is also an important wintering area for migratory ducks and shorebirds, although numbers are usually much smaller than at Kalametiya. Waterfowl recorded during mid-winter censuses in January 1987 and January 1988 included 1,200 garganey, along with small numbers of five species of herons and egrets, 13 species of migratory shorebirds and four species of terns.

Cultural Heritage No information

Local Human Population Activities include fishing, especially for prawns, shifting cultivation, rice cultivation and excavation of shells in adjacent areas. The lagoons formerly supported important prawn fisheries, but these have declined in recent years.

Visitors and Visitor Facilities The nearest accommodation is at Tangalla, some 16km distant.

Scientific Research and Facilities Mid-winter waterfowl censuses have been carried out in recent years. The Ministry of Fisheries maintains a circuit bungalow at the nearby village of Gurupokuna.

Conservation Value Both Kalametiya Kalapuwa, in particular, and Lunama Kalapuwa are important wetlands for both resident and migratory waterfowl.

Conservation Management No information

Management Constraints The area of open water in both lagoons has decreased by more than 50% during the past 30 years, mainly because of siltation. Further growth of mangroves at Kalametiya has accelerated the process of siltation. Other threats include disturbance from fishing activities, excavation of mollusc shells for use in lime kilns, reclamation of land for rice cultivation, and pollution by pesticides originating from the agricultural Walawe Development Scheme to the north. Excessive hunting was reported to be a problem prior to re-notification of the Sanctuary in 1984.

During the late 1950s or early 1960s, excess freshwater from Uda Walawe Reservoir was diverted into Kalametiya Kalapuwa. Subsequently, a groyne and canal were constructed to ensure drainage of water from the lagoon into the sea. As a result, the salinity was permanently depressed and the recruitment of penaeid prawn post-larvae and fish severely obstructed. The fishery that existed prior to these changes collapsed, and now fishing is only a marginally important subsistence activity.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date September 1990

KOKILAI SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Situated on the north-east coast, south-east of Nayaru Lagoon and north-west of Pulmoddai, Mullaitivu and Trincomalee districts, Northern and Eastern provinces. 8°56'-9°03'N, 80°52'-80°58'E

Date and History of Establishment Declared a sanctuary on 18 May 1951.

Area Full Supply Level (approximately 2,995ha)

Land Tenure State

Altitude Sea level

Physical Features Kokilai is a large estuarine lagoon with extensive seagrass beds and some small patches of mangrove swamp and mudflats, particularly along the western and southern

shores. The lagoon is fed by several small streams and is linked to the sea by a narrow, seasonally tidal channel. For much of the year the channel is blocked by a sand bar. The maximum depth near the mouth of the channel is about four metres. The water is brackish, with the salinity increasing to about 30 p.p.t. seasonally.

Climate Conditions are tropical monsoonal.

Vegetation There are extensive seagrass beds and some mangrove swamps. The lagoon is surrounded by cultivated land and scrub, with some patches of open forest.

Fauna Waterfowl include pelicans, cormorants, herons, egrets, storks, ducks and migratory shorebirds, but no recent information is available. The lagoon was once famous as a wintering area for large numbers of greater flamingos *Phoenicopterus ruber*.

Cultural Heritage No information

Local Human Population The lagoon is situated in a densely populated region with many small villages. Activities include prawn fishing, rice cultivation and some shifting cultivation in surrounding areas.

Visitors and Visitor Facilities No information

Scientific Research and Facilities No information

Conservation Value The lagoon is known to be a very important site for a wide variety of waterfowl.

Conservation Management The degree of protection is reportedly very low.

Management Constraints In some years, the connection with the sea remains permanently blocked by a sand bar, preventing recruitment of penaeid post-larvae. Regular marinal breaching is required to sustain shrimp productivity. Parts of the lagoon are used for aquaculture, and the adjacent patches of forest are being cleared for cultivation. The lagoon supports a major prawn fishery.

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

Scott, D.A. (Ed.) (1989). *A directory of Asian wetlands*. IUCN, Gland, Switzerland and Cambridge, UK. 1,181 pp.

Date September 1990

LAHUGALA KITULANA NATIONAL PARK

IUCN Management Category II (National Park)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies in the basin of the Heda Oya, 16km inland from the coastal town of Pottuvil in Eastern Province. The Pottuvil-Moneragala trunk road runs through the south-eastern sector of the park. 6°53'-6°55'N, 81°40'-81°42'E

Date and History of Establishment Created a national park on 31 October 1980, having originally been established as a sanctuary on 1 July 1966.

Area 1,554ha

Land Tenure State

Altitude No information

Physical Features The terrain is flat with occasional rock outcrops. The park features three tanks, Lahugala (243ha), Kitulana and Sengamuwa, which ultimately drain into the Heda Oya. These tanks are largely silted up and support an abundance of beru grass.

Climate Mean annual rainfall is 1650mm (McKay, 1973). There are two dry periods: from May to October and from mid-January to March. The north-east monsoon lasts from November to the end of December (Banks and Banks, 1985).

Vegetation Lying in the dry zone, the vegetation surrounding the tanks is dry mixed evergreen forest with scrub. Common species include weera *Drypetes sepiaria*, palu *Manilkara hexandra*, halmilla *Berrya cordifolia*, milla *Vitex pinnata*, satin *Chloroxylon swietenia* and ehala *Cassia fistula*. Beru *Sacciopelsis interrupta*, a tall reedy grass, covers the tanks. Rivers are fringed by gallery forest.

Fauna Lahugala is traditionally used as a feeding ground by elephant *Elephas maximus* (E). Herds of up to 150, attracted by the beru grass, were a common sight at Lahugala Tank during July and August in the 1980s (G.V. Samarkoon, pers. comm.). Other mammals include endemic toque macaque *Macaca sinica*, common langur *Presbytis entellus*, sloth bear *Melursus ursinus* (I), jackal *Canis aureus*, rusty-spotted cat *Felis rubiginosa*, fishing cat *F. viverrina*, leopard *Panthera pardus* (T), wild boar *Sus scrofa*, Indian muntjac *Muntiacus muntjak*, spotted deer *Cervus axis*, sambar *C. unicolor*, pangolin *Manis crassicaudata* and black-naped hare *Lepus nigricollis*.

The avifauna is diverse and includes a variety of waterfowl, and the usual dry zone forest birds. Wetland species include pelican *Pelecanus onocrotalus*, purple heron *Ardea purpurea*, painted stork *Mycteria leucocephala*, lesser adjutant stork *Leptoptilos javanicus*, teal *Anas* sp., white-

bellied sea eagle *Haliaeetus leucogaster*, grey-headed fishing eagle *Ichthyophaga ichthyaetus*, common kingfisher *Alcedo atthis*, stork-billed kingfisher *Pelargopsis capensis* and white-breasted kingfisher *Halcyon smyrnensis*. The last recorded sighting of comb duck *Sarkidiornis melanota*, now thought to be extinct in Sri Lanka, was at Lahugala (Banks and Banks, 1985). Other birds include the rare red-faced malkoha *Phoenicophaeus pyrrhocephalus* and the endemic Sri Lanka spurfowl *Galloperdix bicalcarata*.

Amphibians include frogs such as the endemic *Bufo athukoralei*, *Rana limnocharis*, *Rhacophorus maculatus*, *Kaloula pulchra* and *Microhyla rubra*. Noteworthy reptiles include python *Python molurus* (V), rat snake *Pythas mucosus*, flying snakes *Chrysopelea* spp., cat snakes *Boiga* spp., whip snakes *Dryophis* spp. and Russell's viper *Vipera russelli* (M. Jansen, pers. comm., 1986).

Cultural Heritage Nearby is the historic site of Magulmahavihara, built for the occasion of King Kavantissas' marriage to Vihavamaha Devi.

Local Human Population None within the park, but there is a small settlement on the boundary.

Visitors and Visitor Facilities Accommodation was available at Lahugala Lodge, but this has been destroyed during the recent civil unrest. Other accommodation can be found at Pottuvil.

Scientific Research and Facilities Some research on elephant ecology and behaviour was conducted in 1967-1969, as part of the Smithsonian Institute's elephant study programme (McKay, 1973).

Conservation Value The park constitutes one of Sri Lanka's smallest but most valuable conservation areas for elephants and endemic birds.

Conservation Management It is proposed to create jungle corridors to link Lahugala with Gal Oya and Yala East national parks.

Management Constraints Poaching, timber extraction for house construction, fuelwood collection and grazing by livestock persist on a limited scale (Department of Wildlife Conservation, pers. comm., 1990; Katugaha, 1982). A major potential threat is the proposed Heda Oya Scheme and development of the lower Uva Basin, which will result in an expansion of cultivated land and further isolate the park and its elephant population (Hoffmann, 1977).

Staff Twenty staff, headed by a ranger (1985)

Budget No information

Local Addresses Park Warden, Lahugala, Amparai District

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Date May 1986, updated September 1990

MADURU OYA NATIONAL PARK

IUCN Management Category II (National Park)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location The park lies between the Polonnaruwa-Batticaloa road and Mahiyangana-Padiyatalawa road in the districts of Amparai, Badulla and Polonnaruwa and spans the border between Eastern and Uva provinces. It is surrounded on the west and north by Mahaweli development areas and on the south and east by teak plantations and jungle, which is subjected to repeated slash-and-burn practices. Main access, from the north, is 25km by road from Mannampitiya, located on the Polonnaruwa-Batticaloa highway. 7°23'-7°35'N, 81°05'-81°20'E

Date and History of Establishment Notified a national park on 9 November 1983 (Gazette No. 270/9) under the Fauna and Flora Protection Ordinance, having been acquired from crown lands pursuant to the Mahaweli Authority Act, 1979.

Area 58,850ha. The park was extended in the east from its original size of 51,468ha on 16 September 1985 (Gazette No. 367/3) in order to provide additional habitat for wildlife and to ensure protection of the immediate catchment of the NDK reservoir. It is proposed to link the park with Gal Oya National Park (25,900ha) in the south via Nilgala Jungle Corridor (10,360ha).

Land Tenure State

Altitude Most of the park lies between 30m and 150m. Maximum altitude is 685m.

Physical Features Degradation of the pre-Cambrian rock has resulted in the formation of a mature mantled and undulating peneplain, broken by a number of prominent remnants of erosion (rock outcrops and ridges). The dominant topographic feature is the 8km-long range of rocky mountains in the south-west of the park. The geological regime comprises alluvium deposits and Miocene limestone. Red earth, relatively fertile but easily eroded, is the predominant soil type. Waterbodies, constituting over 15% of the park, include the Maduru Oya (6,100ha), Ulhitiya (2,300ha), Ratkinda (1,100ha), NDK (800ha) and Henanegala (700ha) reservoirs and tributaries of the Mahaweli and Maduru Oya river systems (MEP/DWLC, 1985, 1987a).

Climate Conditions are influenced largely by the north-east monsoon, or Maha, which lasts from October to late-January. Mean annual rainfall is 1650mm. Annual evapotranspiration rates normally exceed precipitation levels. Mean annual temperature is about 27°C (MEP/DWLC, 1987a).

Vegetation The park is located entirely within Sri Lanka's dry zone, although its southern edge borders on the intermediate zone. The climax community of the area is tropical dry mixed evergreen forest, characterised by weera *Drypetes sepiaria*, buruta (satin) *Chloroxylon swietenia*, palu *Manilkara hexandra*, velang *Pterospermum canescens*, divul (wood apple) *Feronia limonia*, ehela *Cassia fistula* and weliwenna *Dimorphocalyx glabellus*. However, a major part of the forest within the park had been heavily exploited in the past for shifting cultivation. This has resulted in areas of secondary vegetation and vast stretches of open plains, dominated by the grasses illuk *Imperata cylindrica*, guinea grass *Panicum maximum* and *Pennisetum* species. The herbaceous stage is succeeded by shrubs, such as *Lantana camara*, *Ziziphus* species and *Cassia auriculata*. The thicket stage is characterised by *Trema rientalis*. Among the first trees to appear is *Pterospermum canescens*, followed by *Drypetes sepiaria* and *Manilkara hexandra*. Madura Oya Dam is surrounded by parkland, maintained by periodic fires. A rare and endemic tree *Vatica obscura*, the only species of the Dipterocarpaceae to occur in the dry zone, is found in restricted locations on the banks of the Maduru Oya and Gallodai Aru. A large plantation of teak *Tectona grandis*, an exotic, is included in the north-eastern part of the park (M. Jansen, pers. comm., 1985; MEP/DWLC, 1987a).

Fauna The park is important for its rich wildlife, which includes a variety of endemic species. Threatened species of mammal include elephant *Elephas maximus* (E), of which there were 150-250 prior to the park's establishment, sloth bear *Melursus ursinus* (I), leopard *Panthera pardus* (T) and water buffalo *Bubalus bubalis* (E). Other mammals include slender loris *Loris tardigradus*, toque macaque *Macaca sinica*, a Sri Lankan endemic, common langur *Presbytis entellus*, jackal *Canis aureus*, fishing cat *Felis viverrina*, wild boar *Sus scrofa*, Indian muntjac *Muntiacus muntjak*, spotted deer *Cervus axis* and sambar *C. unicolor*. Small mammals include porcupine *Hystrix indica*, black-naped hare *Lepus nigricollis*, Indian pangolin *Manis crassicaudata*, squirrels, rats and mice. The rich aquatic avifauna includes painted stork *Mycteria leucocephala*, white-bellied sea eagle *Haliaeetus leucogaster*, grey pelican *Pelecanus philippensis*, great cormorant *Phalacrocorax carbo* and little cormorant *P. niger*. Noteworthy forest species are the endemic Sri Lanka junglefowl *Gallus lafayettei*, the rare broad-billed roller *Eurystomus orientalis* (possibly the only location in the dry zone), common tailor-bird *Orthotomus sutorius*, shama *Copsychus malabaricus*, black-hooded oriole *Oriolus xanthornus* and woodpecker *Dendrocopos nanus*. Red-faced malkoha *Phaenicophaeus pyrrhocephalus*, endemic to Sri Lanka and S. India, is also present. Reptiles include tortoise *Geochelone elegans*, common monitor *Varanus bengalensis*, water monitor *V. salvator*, python *Python molurus* (V), krait *Bungarus* spp., common cobra *Naja naja*, mugger *Crocodylus palustris* (V) and estuarine crocodile *C. porosus* (E). Of fishes, barbs *Barbus* spp., giant gourami *Osphronemus goramy* (possibly introduced), snakeheads *Channa* spp., catfish (Siluriformes) and tilapia *Tilapia mossambica* (an exotic) are predominant in the reservoirs (M. Jansen, 1984; M. Jansen, pers. comm., 1985; MEP/DWLC, 1987a).

Cultural Heritage Ruins at Henanigala, Kudawila, Gurukumbura, Uluketangoda, Werapokuna and several other places include ancient Buddhist shrines, temples, dagobas, statues and hermitages from different eras in Sri Lankan history. An ancient sluice on the old breached earthen bund of the Maduru Oya was discovered recently. The sluice, consisting of stone slabs and bricks, is about 30ft high, 30ft wide and 219ft long. The upper sluice was built in two stages, the first of which dates back to before the 6th century BC. The lower sluice is believed to be even older. Another ancient bund, known as Watawala Kandiya, is situated 23km south of the Maduru Oya Dam. Ruins of an ancient dewalaya are at Verapokuna in the south. Early Brahmin

inscriptions, from the first to third century BC, have been discovered at Kandegamakanda (MEP/DWLC, 1985).

Veddas, aboriginals, numbering less than a thousand people, lived in Kandeganwela, Kotatalawa, Dambana and other places in the park prior to its declaration. The temple of Mahiyangana, of great religious significance to the Veddas, is located outside the park. The Veddas, believed to have descended from King Vijaya and Queen Kuwana, were present in Sri Lanka long before the arrival of the Sinhalese from India in 543 BC. Traditionally hunters and gatherers, they have increasingly relied on small scale cultivations for their livelihood (MEP/DWLC, 1985; Hemipriya, 1985). Families living at Dambana have retained a traditional lifestyle to some extent (Uragoda, 1969).

Local Human Population A few Vedda families still reside in the south-west of the park. Legal action has been taken and it is likely that they will be resettled in the Mahaweli area (Department of Wildlife Conservation, pers. comm., 1990).

Visitors and Visitor Facilities The park is due to be opened to the public shortly (Department of Wildlife Conservation, pers. comm., 1990). A full range of visitor facilities and accommodation are nearing completion.

Scientific Research and Facilities Studies of the elephant population under WWF/IUCN Project 1783 (Ishwaran, 1985) were instrumental in the park's establishment. An environmental impact assessment, sponsored by US-AID, has been carried out by TAMS (1980). Further research requirements, as applied to management, have been identified (MEP/DWLC, 1985). The Open University of Colombo and the Eastern University, Batticaloa, are conducting studies on the flora and fauna (Scott, 1989), and the Department of Wildlife Conservation on the avifauna (S.R.B. Dissanayaka, pers. comm., 1990). Some facilities for scientists are available at Kandeganwila.

Conservation Value As well as providing a refuge for wildlife, particularly elephants, this new park is designed to protect the immediate catchments of five reservoirs, developed under the Accelerated Mahaweli Programme. Conservation of these catchments is crucial to the success of the project.

Conservation Management A draft management plan was prepared in October 1985 (MEP/DWLC, 1985) and subsequently revised during a series of planning and development workshops, culminating in a final plan in June 1987 (MEP, DWLC, 1987a). Objectives extend beyond maintaining biological diversity and water quality and quantity to habitat enrichment, reforestation, developing waterholes in dry areas and reducing exotic fauna and flora, notably teak and *Salvinia*. Socio-economic objectives include developing visitor facilities, expanding the conservation education programme within the local community and providing it with benefits from the park. The park consists of a complex of ecosystems, both natural and man-modified, and has been divided into natural, cultural resource and development zones, with a surrounding buffer zone to facilitate management. Plans to develop the administrative infrastructure are based on the park's division into three management units, two of which (Ulhitiya and Bogama) will be administered from new ranger stations. The third, Madura Oya Range, will be administered from park headquarters, to be established just south of the complex built to service the construction of the dam and now occupied by the army (MEP/DWLC, 1987b). Once military

use of the area ceases, it is proposed that this facility is returned to MEP/DWLC control (MEP/DWLC, 1987a).

Management Constraints An increase in spontaneous colonisation of land in the park by persons hoping to obtain title deeds to land under the Accelerated Mahaweli Programme resulted in considerable disturbance to the wildlife. Forests were cut and burned, cash crops grown and homes built in the park. The squatters, numbering about 1,500, have since been moved to newly established Mahaweli settlements (Jansen, 1984). As part of the Accelerated Mahaweli Programme, 70 Vedda families from the villages of Kandeganwila, Kotabankina, Keragoda and Koteyaya have been resettled nearby at Henangala (Hemapriya, 1983), but the head of the community, Tissahami, has opted to remain (MEP/DWLC, 1985). The removal of Veddhas has been much publicised (Anon, 1984; M. Colchester, 1984). Hunting is a major threat. Feared consequences of the Accelerated Mahaweli Programme include conflicting interests between wildlife and settlers in sections of the park that abut the development area: elephant and wild boar damage and raid crops, while livestock and other domestic animals trespass into the park. The new road connecting Maha Oya through Aralaganwila to the existing road near Polannaruwa bisects the north-eastern part of the park. Construction of dams, tunnels and roads has resulted in badly scarred landscapes, particularly at Henanegala, Enderawetamulla and along the Maha Oya-Ardaganwila highway. All of these sites have been recommended for reclamation. The steep-sided irrigation channels are a hazard to wild (and domestic) animals, which occasionally fall into them and are unable to climb out. Maduru Oya Reservoir is covered with the noxious floating weed *Salvinia molesta*. Measures for its physical eradication are underway (MEP/DWLC, 1985, 1987a). The Sri Lankan army has appropriated a portion of the park at its north entrance (Hoffmann, 1987).

Staff One park warden, four rangers, five range assistants, 38 game guards and ancillary staff (1990)

Budget Funds are being provided by US-AID through the Mahaweli Environment Project up until 1991. The budget for 1986 includes estimates for capital investment (Rs 3,080,000), natural resources development (Rs 1,910,000), equipment (Rs 1,482,625), technical assistance including training (Rs 3,687,500 for all four national parks within the Mahaweli development area) and recurrent costs (Rs 5,340,000). The total cost of funding the park development schedule is estimated to be Rs 26,448,000 (MEP/DWLC, 1987a).

Local Addresses Warden, Maduru Oya National Park, Madura Oya, Aralaganwila

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Date April 1985, updated September 1990

MINNERIYA-GIRITALE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Situated 20km north-west of Polonnaruwa, Polonnaruwa District, North-Central Province. 7°59'-8°04'N, 80°52'-80°54'E

Date and History of Establishment Minneriya-Giritale was declared a sanctuary on 29 July 1938, part of which was designated a national biosphere reserve in the late 1970s (Bharathie, 1979). The nearby Minneriya-Giritale Nature Reserve (7,529ha), established on 12 February 1988, has been recommended for upgrading to a national park in view of its conservation importance (T.W. Hoffmann, pers. comm., 1989).

Area 6,693ha. The national biosphere reserve covers 809ha (Bharathie, 1979).

Land Tenure Minneriya and Giritale tanks are state owned; surrounding areas are partly state-owned and partly privately-owned.

Altitude Ranges from approximately 100m to 885m at the top of Wenigala Peak.

Physical Features The topography is varied, with hills, patnas and talawas. Minneriya is an ancient irrigation tank, with a capacity of 2,550ha when full and a catchment area of 24,000ha. The main source of water is from a diversion of the Amban Ganga, along the Elahara Channel.

Maximum depth is 10.7m; the water is fresh with a pH of 7.5. Details of Giritale Tank are not available.

Climate Conditions are tropical monsoonal climate. Mean annual rainfall is about 1146mm and mean annual temperature 27.5°C.

Vegetation Minneriya Tank is surrounded by dry mixed evergreen forest. The phytoplankton is dominated by *Microcystis* and *Melosira*. No information is available on the aquatic macrophytes.

Fauna Much of Sri Lanka's wildlife, including elephant *Elephas maximus* (E), is found in the nature reserve (T.W. Hoffmann, pers. comm., 1989). Minneriya Tank is known to support small numbers of a wide variety of waterfowl including pelicans, cormorants and storks, but no details are available.

Economically important fishes include *Labeo dussumieri*, *Puntius sarana*, *P. dorsalis*, *P. chola*, *Cyprinus carpio*, *Wallago attu*, *Ompok bimaculatus*, *Heteropneustes fossilis*, *Macrones vittatus*, *Tilapia mossambica*, *Etroplus suratensis*, *Osphronemus goramy*, *Ophiocephalus striatus*, *Glossogobius giuris* and *Mastacembelus armatus*.

Cultural Heritage Minneriya was built by King Mahasena in the 3rd century AD. A small temple was built in his memory (Hulugalla, 1973).

Local Human Population Minneriya tank is situated in a fairly densely inhabited area. It is used for fishing, and as a water supply for irrigation, domestic use, and brick-making at low water levels during the dry season. Annual production of fish is estimated at 873 metric tonnes.

Visitors and Visitor Facilities No information

Scientific Research and Facilities The Mahaweli Environment Project Systems Centre, with research, educational and meeting facilities, is being built on the shores of Minneriya tank.

Conservation Value The core of the nature reserve is an uninhabited area in one of the country's most diverse natural systems, with intermediate forest, bamboo stands, patnas and talawas. Nowhere else does it seem that such diversity is represented within a single protected area, particularly in such an intact state (T.W. Hoffmann, pers. comm., 1989). The tanks support a variety of waterfowl, as well as being of socio-economic value.

Conservation Management No information

Management Constraints Include dumping of paddy husks.

Staff No information

Budget No information

Local Addresses No information

References Unless otherwise indicated, this information is taken directly from Scott (1989).

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Date September 1990

PEAK WILDERNESS SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies in the centre of the western ridge of the Central Highlands, north-east of Ratnapura, and straddles the border between Central and Sabaragamuwa provinces. To the north is the tea-growing area of Hatton Plateau. 6°44'-6°54'N, 80°25'-80°49'E

Date and History of Establishment 25 October 1940

Area 22,380ha. Horton Plains National Park (3,160ha) adjoins the eastern boundary.

Land Tenure State, including state-owned tea and forest plantations

Altitude The Peak Wilderness Range rises steeply from the southern lowlands (50m) near Ratnapura to a plateau, averaging 600m and interrupted by such mountains as Sri Pada (Adam's Peak) at 2,238m.

Physical Features It is an important watershed for three major river systems: the Kelani Ganga, which flows north-westwards; the Kalu Ganga, which flows southwards and supplies Ratnapura; and the Walawe Ganga, which drains into the Uda Walawe Reservoir to the south-east. Underlying the entire area is the Highland Series of pre-Cambrian rocks, which are highly crystalline and non-fossiliferous. Soils are red-yellow podzols.

Climate Peak Wilderness has been described as "the most constantly wet part of Asia west of Borneo" (Greller *et al.*, 1987). Mean annual rainfall is 5123mm at Hapugastenne Estate (594m), 3081mm and at Maskeliya Hospital (1,280m). Mean annual temperature ranges between 27.2°C in Ratnapura (40m) and 15.4°C in Nuwara Eliya (1,900m).

Vegetation Peak Wilderness is one of the few remaining areas in Sri Lanka with continuous tracts of altitudinally graded forest, ranging from lowland rain forest to high altitude cloud forest. Lowland forest is restricted to a few small areas on the lower slopes of the Peak Wilderness Range. The continuous, 30-40m high canopy is interrupted in places by taller individual emergents rising to 60m. Dipterocarpaceae (*Dipterocarpus*, *Shorea* and endemic species of *Doona*) predominate, interspersed with representatives of the genera *Cullenia*, *Mesua*,

Palaquium and *Semicarpus*. Due to the dense nature of the canopy, the shrub layer is poorly developed. Gaps in the canopy, both natural and man-induced, are invaded by saplings of *Calamus* sp., which form impenetrable thickets. From 600m to 900m the lowland forest gradually gives way to montane rain forest, characterised by a lower canopy of *Doona* and *Stemonoporus rigidus* (rediscovered in 1981) with *Garcinia echinocarpa* and the vine *Leucocodon zeylanicum*. *Shorea gardneri* survives on the more sheltered slopes up to an altitude of 1700m, the known limit for this tropical dipterocarp in Asia. Other species growing with *Doona* include *Litsea* sp., *Actinodaphne* sp. and *Cinnamomum*, *Syzygium* spp., *Myristica dactyloides*, *Fahrenheitia* (*Ostodes*) *zeylanica*, *Semecarpus nigroviridis* and *Palaquium rubiginosum*.

Montane cloud forest, which occurs above 1,700m, is confined to a narrow strip along the ridge line and slopes of Adams Peak. Its composition differs considerably from that of the high altitude forests of the Nilgiris and Palnis in nearby South India and is characterised by *Calophyllum walkeri* and *C. trapezifolium*. Extensive marshland occurs on the plateau, together with stunted trees of *Syzygium revolutum* and *Gordonia speciosa* and shrubs such as *Hedyotis* spp. and *Osbeckia walkeri*. Typical marshland species include rush *Juncus prismatocarpus*, sedges *Scirpus fluitans* and *Carex* sp., grass *Garnotia mutica*, clubmoss *Lycopodium carolinianum* and ferns *Histiopteris* sp. and *Gleichenia* (*Dicranopteris*) *linearis*. Characteristic flowering plants are *Impatiens* spp., *Exacum walkeri*, *Sonerila* spp., *Vernonia* spp., *Senecio ludens*, *Emilia glabra* and orchid *Phalus tancarrvilleae*. A small population of the uncommon *Burmattia coelestis* is present, as well as several interesting species of *Eriocaulon* (Greller *et al.*, 1981). The flat areas of the plateau and the hilly spurs support communities of *Garcinia echinocarpa*, in association with prickly palm *Oncosperma fasciculatum* and with a straggling undergrowth of *Strobilanthes* brushwood. A noteworthy shrub is the bushy *Schumacheria alnifolia*, endemic to Sri Lanka, which is host to the climbing *Freycinetia* spp.

Fauna Elephant *Elephas maximus* (E) has virtually disappeared from the region, but a remnant population, estimated at 30-50 individuals, still survives in the sanctuary (T.W. Hoffmann, pers. comm., 1988). Mammals still present in reasonable numbers include Kelaart's long-clawed shrew *Feroculus feroculus* (a monotypic genus endemic to the montane regions of Sri Lanka), toque macaque *Macaca sinica* (endemic), purple-faced langur *Presbytis senex* and leopard *Panthera pardus* (T). The contiguous areas of Peak Wilderness Sanctuary and Horton Plains Nature Reserve contain all 21 species of bird endemic to the country, of which Sri Lanka coucal *Centropus chlororhynchus* and white-headed mynah *Sturnus senex* occur only in the former. One of the strongholds of the greatly endangered broad-billed roller *Eurystomus orientalis* is the southern periphery of the sanctuary, which is subject to cultivation (Hoffmann, 1984). Among invertebrates, the Sri Lankan relict ant *Aneuretus simoni* (K) is reported from the area (Wells *et al.*, 1983).

Cultural Heritage Sri Pada (Adam's Peak) is sacred and for centuries has attracted Buddhist, Hindu and Moslem alike. It is thought that pilgrims used to travel *via* Horton Plains along the ridge of Peak Wilderness to reach Sri Pada, a route that is no longer evident (Werner, 1982). According to legend, the tomb of Adam is found here. Also present is the outline of a footprint, claimed by some to be that of Gautama Buddha and by others to be that of Siva (Holugalla, 1973).

Local Human Population No information

Visitors and Visitor Facilities Large numbers of pilgrims and tourists visit Sri Pada. Facilities are limited to tea stalls along the trails to Sri Pada during the pilgrimage season.

Scientific Research and Facilities Includes studies of floristic composition and the status of *Stemonoporus*-dominated forests (Greller *et al.*, 1981, 1985, 1987).

Conservation Value Peak Wilderness is considered to be the most valuable conservation area in Sri Lanka, with the highest number of endemics, notably birds, reptiles and amphibians, and the greatest biological diversity due to altitudinal and climatic factors. Together with adjoining forest reserves, such as Gilimale and Kelani Valley, it covers the entire range of Wet Zone forests from the foothills right up to the highest peaks (Hoffmann, 1984, 1988).

Conservation Management It has been suggested that a new Highland National Park be established, comprising Peak Wilderness Sanctuary and the adjacent Horton Plains National Park. It is considered that this site merits inscription on the World Heritage List. Various extensions and alterations to the existing boundaries have been recommended, to enhance the biological integrity of the site (Hoffmann, 1988).

Management Constraints The main encroachments are the planting (pine and eucalyptus plantations) and felling activities of the Forest Department, carried out in direct contravention of the Fauna and Flora Protection Ordinance. By comparison, encroachments by villagers are negligible and confined mostly to the Maliboda area on the western boundary (Hoffmann, 1984, 1988). The annual pilgrimage to Adam's Peak, when thousands of tea stalls and shops are erected along the route, is a source of considerable disturbance and results in the cutting of forest and unsightly litter (Hoffmann, 1988). Former gem mining activities have disturbed the marshland habitat on the plateau, by interfering with normal hydrological processes, but these gem pits are gradually being recolonised by the vegetation (Greller *et al.*, 1981). However, gem mining persists (T.W. Hoffmann, pers. comm., 1986).

Staff Eleven

Budget No information

Local Addresses Game Ranger, Sri Palabaddala

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Date April 1986, updated September 1990

POLONNARUWA SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies in the north-west of the dry zone near the township of Polonnaruwa. 07°56'N, 81°00'E

Date and History of Establishment Created a sanctuary in 1938. The Ancient City of Polonnaruwa was designated a cultural World Heritage Site in 1982.

Area 1,523ha

Land Tenure State

Altitude Less than 10m above sea level.

Physical Features Topography is generally flat. Soils are typically reddish brown earths.

Climate Temperature ranges from 26°C to 30°C. Mean annual rainfall over 42 years is 1671mm, with a period of marked drought from May to September.

Vegetation Following the abandonment of the ancient capital of Polonnaruwa some 700 years ago, secondary semi-evergreen forest has developed and been maintained subject to some removal of the shrub layer in the vicinity of archaeological sites. Dittus (1977) recorded 61 tree species within a study area of 3 sq.km, representing 50 genera and 25 families. *Drypetes sepiaria*, with a relative density of 21%, is predominant. Other trees, with a relative density of 5% or more, are *Premna tomentosa*, *Vitex pinnata*, *Cassia fistula*, *C. roxburghii* and *Grewia polygama*. Species occurring exclusively on the periphery of Parakrama Samudra Lake or along the banks of the irrigation channel that borders the study area are: *Morinda tinctoria*, *Azadirachta indica*, *Streblus asper*, *Madhuca longifolia*, *Eugenia bracteata*, *Lannea coromandelica* and *Alstonia scholaris* (M. Jansen, pers. comm., 1986).

Fauna The reserve is rich in primates, which include slender loris *Loris tardigradus*, toque macaque *Macaca sinica*, common langur *Presbytis entellus* and, at a density of 215 animals/sq.km (Rudran, 1979), purple-faced langur *P. senex*. Both toque macaque and purple-

faced langur are endemic to Sri Lanka. Other large mammals are absent, with the exception of mouse deer *Tragulus meminna*, and perhaps spotted deer *Cervus axis* and wild boar *Sus scrofa*.

Some 146 species of birds have been recorded, of which 74 species breed in the sanctuary (M. Jansen, pers. comm., 1986). Most of the avifauna characteristic of the low country dry zone is represented. Noteworthy species include little minivet *Pericrocotus cinnamomeus*, white-breasted kingfisher *Halcyon smyrnensis*, large cuckoo shrike *Coracina novaehollandiae*, black-headed oriole *Oriolus xanthornus*, shikra *Accipiter badius*, brown-headed barbet *Megalaima zeylanica*, crimson-breasted barbet *M. rubricapilla*, red-backed woodpecker *Dinopium benghalense*, brahmyn kite *Haliastur indus*, white-bellied sea eagle *Haliaeetus leucogaster*, white-bellied drongo *Dicrurus caerulescens*, thick-billed flowerpecker *Dicaeum agile*, Jerdon's chloropsis *Chloropsis cochinchinensis*, Pompadour green pigeon *Treron pompadora* and two species of parakeet *Psittacula* spp. (M. Jansen, pers. comm., 1986).

Reptiles include a variety of snakes, such as python *Python molurus* (V) and cobra *Naja* sp. (Department of Wildlife Conservation, pers. comm., 1990).

Cultural Heritage Polonnaruwa first became a royal residence in 368 AD, when the lake of Topawewa was formed, but it did not become the capital until the middle of the 8th century. The principal ruins are of a later date, however, being chiefly of the time of Parakrama Bahu (1153-1186). Polonnaruwa seems to have been abandoned in about 1288, owing to a breach in the dam, but has recently been recolonised. Further details of the site are given by Hulugalla (1973) and Rushbrook Williams (1975).

Local Human Population None within the sanctuary

Visitors and Visitor Facilities Hotel accommodation is available nearby. A hostel for Buddhist monks is under construction near Gal-Vihara. Well-maintained gravel tracks provide easy access to the cultural sites. Guides are available.

Scientific Research and Facilities Excavations and restoration work are being carried out under the Cultural Triangle Project. The primate community is the subject of a long-term ecological/behavioural study supported by the Smithsonian Institution.

Conservation Value The sanctuary was established to protect the ancient city of Polonnaruwa which is of world cultural importance. It is also important for its relatively high diversity of primates.

Conservation Management The ruins of Polonnaruwa are being restored under the Cultural Triangle Project sponsored by Unesco. They are fenced off and protected.

Management Constraints Cutting of young trees for construction-poles is not always prevented. The vegetation is subject to disturbance from archaeological work. Pressure from the large number of visitors is high.

Staff Eight

Budget No information

Local Addresses Game Ranger, Polonnaruwa Sanctuary, Circular Road, Polonnaruwa

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Date April 1986, updated December 1988

RITIGALA STRICT NATURAL RESERVE

IUCN Management Category I (Strict Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies in the Anuradhapura District of North Central Province, about 27km north of Dambulla and 36km south-east of Anuradhapura. It is accessible from the Habarana-Kekirawa highway near Yakkala. 8°05'-8°09'N, 80°38'-80°40'E

Date and History of Establishment Declared a strict natural reserve on 7 November 1941 (Gazette Notification No. 8809). The reserve takes its name from riti *Antiaris toxicaria*, a tree species characteristic of the middle slopes (Fernando, 1968).

Area 1,528ha

Land Tenure State

Altitude Ranges from 125m to 766m at the top of Ritigala, which is the highest peak in the dry zone of Sri Lanka.

Physical Features Ritigala stands out as a prominent erosion remnant on the island's lowest peneplain. The 6.5km-long, isolated hill range is divided by the shallow Maha-degala gorge into southern and northern blocks. Ritigala is drained by tributaries of the Malwata Oya. The range is underlain by pre-Cambrian, metamorphosed igneous and sedimentary rocks, mainly charnokite, quartzite and marble, of the Highland Series (Cooray, 1967). Further details of the geology and topography are given by Fernando (1968) and Jayasuriya (1984), respectively. Soils are generally acidic podzols with a pH of 4.7-6.8 (Panabokke, 1967). The steep slopes are highly eroded, and covered in boulders, and the plains have an alluvial upper layer. Soil depth varies from 50cm to 200cm.

Climate Data are not available. Those for Maha-Illupallama, which is in the lowlands 24km to the south-west, are probably representative of a warmer climate. Mean annual rainfall is about 1475mm, 55% of which occurs in October-January and 25% in March-May (Muller-Dombois, 1968). Similarly, 1444mm has been recorded from the nearest station at Maradan Kadawala (Fernando, 1968). Mean air temperature is 27°C, with distinct diurnal and seasonal fluctuations. Wind velocity is highest from June to October (Jayasuriya and Pemadasa, 1983).

Vegetation Ritigala has a unique and interesting flora and is often referred to as a refugium for many rare and threatened species of plants. The hill range provides a variety of environments, influenced by altitude, precipitation, temperature, wind and edaphic factors, simulating a zonation from dry to humid climates and supporting numerous species which are otherwise distributed over a vast area with diverse climates. Jayasuriya (1980, 1984) recorded over 400 taxa from this reserve of which about 80 are non-flowering species. Of 329 flowering plants, 54 (16.4%) species are endemic to Sri Lanka. Species such as *Anodendron rhinosporum*, *Ipomea jacunda*, *I. wightii*, *Strobilanthes stenodon*, *Cleidion nitidum*, *Acampe rigida*, *Bulbophyllum crassifolium*, and *Cheirostylis parvifolia* are extremely rare or extinct elsewhere, not having been recorded outside Ritigala during this century. Three species, namely *Coleus elongatus*, *Madhuca clavata* and *Thunbergia fragrans* var. *parviflora* are known only from Ritigala.

The lower slopes comprise dry mixed forest and grade into an intermediate forest, in which canopy trees include *Madhuca longifolia*, *Pterospermum canescens*, *Dialium ovoideum*, *Hydnocarpus venenata*, *Berrya cordifolia*, *Diospyros ebenum*, *Tetramelis nudiflora*, *Mangifera zeylanica*, *Mesua ferrea* and *Pterygota thwaitesii*. This forest is tall and luxuriant and the canopy reaches over 30m. In the lower strata, species such as *Dimorphocalyx glabellus*, *Mischodon zeylanicus*, *Drypetes sepiaria*, *Cleistanthus patulus*, *Streblus taxoides*, *Vitex altissima*, *Polyalthia korinti* and *P. coffeoides* are common. Forest above 300m gradually diminishes to 15-20m in height and common species include *Pterospermum canescens*, *Sageraea thwaitesii*, *Myristica ceylanica*, *Chrysophyllum roxburghii*, *Dimocarpus longan* and *Ficus microcarpa*. The lower strata are species such as *Mallotus rhamnifolius*, *Cleistanthus patulus*, *Streblus taxoides*, *Ardisia missionis* and *Excoecaria crenulata*. Vegetation on the summits and higher slopes is affected by the wind, higher rainfall, lower temperatures, and frequent cloud cover, as indicated by its composition and the dense, dwarf nature of its arboreal component. Species such as *Cleistanthus patulus*, *C. pallidus*, *Neolitsea cassia*, *Eugenia rotundatata*, *Syzygium zeylanicum*, *Erythroxylum obtusifolium*, *Glochidion stellatum* and *Salacia reticulata* form the matrix of the forest while shrubs such as *Lasianthus strigosus*, *Psychotria nigra*, *Polyalthia korinti*, and *Ardisia missionis* constitute the undergrowth. The abundant epiphytic flora is indicative of the higher precipitation at upper altitudes, and consists of lichens, bryophytes, ferns and orchids. Quantitative data show that *Cleistanthus patulus* is the most abundant tree species, while Euphorbiaceae is the important family (Jayasuriya, 1980, 1984; Jayasuriya and Pemadasa, 1983).

Fauna Ritigala harbours a variety of large mammals, notably the endemic toque macaque *Macaca sinica*, sloth bear *Melursus ursinus* (I), leopard *Panthera pardus* (T) and elephant *Elephas maximus* (E). Other mammals include slender loris *Loris tardigradus*, common langur *Presbytis entellus*, jackal *Canis aureus*, rusty-spotted cat *Felis rubiginosa*, fishing cat *Felis viverrina*, striped-necked mongoose *Herpetes vitticollis*, Indian muntjac *Muntiacus muntjak*, spotted deer *Cervus axis*, sambar *C. unicolor*, wild boar *Sus Scrofa*, porcupine *Hystrix indica*, pangolin *Manis crassicaudata* and several species of bats (M. Jansen, pers. comm., 1986).

The avifauna includes several species endemic to Sri Lanka, namely spotted-winged thrush *Zoothera spiloptera*, Sri Lanka junglefowl *Gallus lafayettei* and Sri Lanka spurfowl *Galloperdix bicalcarata*. Other species are racket-tailed drongo *Dicrurus paradiseus*, grey hornbill *Tockus griseus*, Malabar pied hornbill *Anthracerus coronatus*, blue-faced malkoha *Rhopodytes viridirostris*, rufous woodpecker *Micropternus brachyurus*, rufous-bellied hawk-eagle *Hieraaetus kienerii*, black eagle *Ictinaetus malayensis*, and mountain hawk-eagle *Spizaetus nipalensis* (M. Jansen, pers. comm., 1986).

Among the amphibians are a variety of anurids: *Rhacophorus leucomystax*, *Kaloula pulchra*, *Bufo fergusonii*, *Rana hexadactyla*, *R. limnocharis*, *Hylarana temporalis*, *Philautus variabilis* and *Ramanella variegata*. The reptile fauna is varied and includes gekkos such as the endemic *Gekoella yakhuna*, *Hemidactylus lesehenaulti*, *H. triedrus*, endemic *Gymnodactylus frenatus* and *Cnemaspis kandianus*. Skinks include *Mabuya carinata*, *M. macularia* and *Riopa punctata*, while the snakes commonly seen are python *Python molurus* (V), rat snake *Pythas mucosus*, flying snake *Chrysopelea ornata*, Forsten's cat snake *Boiga forsteni*, Russell's viper *Vipera russelli*, endemic green pit viper *Timeresurus trigonecephalus*, green whip snake *Dryophis nasutus* and brown whip snake *D. pulverulentus*. Common among the lizards is *Calotes versicolor* (M. Jansen, pers. comm., 1986).

Cultural Heritage The ruins of Ritigala are of archaeological interest and mostly comprise the remains of an ancient Buddhist monastery founded in the first half of the 9th century by the forest-dwelling sect of monks known as Pamsukulika bhikkus. The earliest inscriptions, however, date back to the 4th century BC (Jayasuriya, 1984).

Local Human Population None

Visitors and Visitor Facilities There are no facilities. Accommodation is available at Habarana for tourists visiting the monastic ruins.

Scientific Research and Facilities There have been several intensive floristic surveys of Ritigala (Trimen, 1889; Willis, 1906, 1922; Jayasuriya, 1935.) More recently, the flora and ecology of the forest communities has been studied (Jayasuriya, 1980, 1984; Jayasuriya and Pemadasa, 1983).

Conservation Value Ritigala is one of very few high altitude forests representative of the dry zone in Sri Lanka, another being Moneragala. It is extremely important, not only as a refugium for many rare and threatened species, including a number which are endemic to the locality, but also because its isolation provides ideal conditions for the evolution of species. In particular, the flora of Ritigala is unique, being of great evolutionary and ecological interest (Jayasuriya, 1984).

Conservation Management Legally, entry to the reserve is prohibited except for scientific research purposes. In practice, no effective management regime has been established. It has been recommended that the reserve should be enlarged to include the peripheral hills of Kumbukwalahinna to the north, Bathalanwala to the south, and Madu-kanda to the west to form an effective buffer (Jayasuriya, 1984). It has also been suggested that Ritigala should be linked to Hurulu Biosphere Reserve by means of a corridor (T.W. Hoffmann, pers. comm., 1986).

Management Constraints Unauthorised entry, illicit timber felling, poaching and encroachment from chena (shifting cultivation) are the main threats. Extraction of timber from the lower slopes was brought to the attention of the Prime Minister who ordered an official inquiry into the matter. Poachers frequently gather rattan *Calamus thwaitesii*, medicinal products and honey. Vigilance by the Department of Wildlife Conservation has been lacking (T.W. Hoffmann, pers. comm., 1986; N. Ishwaran, pers. comm., 1986; A.H.M. Jayasuriya, pers. comm., 1986).

Staff Eleven

Budget No information

Local Addresses Game Ranger, Anuradhapura

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Date April 1986, updated September 1990

RUHUNA (YALA) NATIONAL PARK, YALA STRICT NATURAL RESERVE

IUCN Management Category

Ruhuna National Park:
Yala Strict Natural Reserve:

II (National Park)
I (Strict Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese monsoon forest)

Geographical Location Lies 24km north-east of Tissamaharama on the south-east coast of Sri Lanka and spans Southern and Uva provinces. Yala Strict Natural Reserve is an integral part of Ruhuna National Park, which is contiguous to Yala East National Park (18,149ha). 6°16'-6°42'N, 81°15'-81°41'E

Date and History of Establishment Block I of Ruhuna National Park was established on 25 February 1938, having previously been a Resident Sportsmen's Shooting Reserve in 1900. Further blocks were established in subsequent years: Block II on 3 September 1954 (originally proclaimed as Yala Sanctuary in 1900), Block III on 28 April 1967, Block IV on 9 October 1969 and Block V on 5 October 1973. Yala Strict Natural Reserve was created on 1 March 1938. Further details concerning the early establishment of Ruhuna are given by Hoffmann (1969). Salm (1975) has recommended that the national park be extended offshore to include Great and Little Basses, considered to be among the finest reefs in Sri Lanka. Further details of these sites are given in UNEP/IUCN (1988).

Area	Ruhuna National Park:	97,878ha
	Yala Strict Natural Reserve:	28,904ha

The total area of the complex is 126,782ha. The national park consists of 14,102ha in Block I (originally 13,680ha but enlarged by 207ha on 3 March 1968 and 215ha on 7 December 1973), 9,927ha in Block II, 40,774ha in Block III, 26,418ha in Block IV, and 6,656ha in Block V.

Land Tenure State

Altitude Ranges from sea level to 90m-high inselbergs.

Physical Features Comprises coastal plain with a number of scattered inselbergs, associated with which are a number of caves and kema (pools). There are also several freshwater lakes and brackish lagoons, described elsewhere (Scott, 1989). Most of the park is underlain by the Vijayan series, a variety of Lower Palaeozoic gneissic rocks formed about 600 million years ago. It is the more resistant parts of these rocks that form the inselbergs. Principal rock types are migmatites and granite-gneisses, biotite-gneiss and hornblende-gneiss. Fossiliferous limestones, sandstones and marls of Miocene age, lying almost horizontally on the Vijayan, outcrop as thin beds along the coast. Pleistocene alluvial and aeolian deposits cover the Vijayan near main rivers and over much of the coastline. The eastern boundary, formed by the sea, is marked by sand dunes of up to 30m high and broad sandy beaches. Red-brown earths and non-calcic brown soils predominate but patches of loose, sandy soil are common along the eastern border and the northern region consists mainly of clay.

Climate The park lies in a transition zone between the single wet season experienced on the east coast and the double peak of precipitation found along the south coast of the island. Mean annual rainfall varies between approximately 900mm in the south to 1300mm in the north, with an extensive period of drought from May to September. Mean annual temperature is 27°C (Mueller-Dombois, 1972a).

Vegetation Comprises secondary forest, possibly a few hundred years old at the most (S.K.R., 1970). It is predominantly semi-arid thorn-scrub, interspersed with pockets of fairly dense forest, and characterised by species such as palu *Manilkara hexandra*, satin *Chloroxylon swietenia*, weera *Drypetes sepiaria*, mayila *Bauhinia racemosa* and malithan *Salvadora persica* and less frequently chala *Cassia fistula*, kohomba *Azadirachta indica* and divul *Feronia limonia*. Shrub vegetation consists of andara *Dichrostachys cinerea*, kukuruman *Randia dumetorum*, eraminiya *Ziziphus* sp., *Gymnosporia emarginata* and karamba *Carissa spinarum*. Islands of forest scrub are scattered among littoral vegetation in the sand dune zone. The forest scrub comprises mayila, andara, palu, malithan, eraminiya, kukuruman, *Diospyros ferrea*, panaka

Pleurostylie opposita, *Gymnosporia emarginata* and *lolu Cordia* sp. This vegetation is of low stature and is stunted or prostrate nearer the coast. *Crinum zeylanicum* colonizes the bare sand. Small patches of mangrove vegetation occur along the coastal lagoons at Buttawa, Yala and Pilinawa. Common species are *kirilla Sonneratia caseolaris*, *ikili Acanthus ilicifolius*, *kadol Rhizophora mucronata*, *Avicennia marina*, *hin kadol Aegiceras corniculatum*, *tala-kiriya Excoecaria agallocha* and *beriya Lumnitzera racemosa*.

Fauna A total of 32 species of mammals has been recorded (Santiapillai, n.d.) but this list does not include Insectivora and is incomplete for Chiroptera and Rodentia. Threatened species are sloth bear *Melursus ursinus* (I), leopard *Panthera pardus* (T), elephant *Elephas maximus* (E) and water buffalo *Bubalus bubalis* (E). Although the water buffalo is indigenous to Sri Lanka, it is likely that most populations contain some genetic input from domestic stock or are descended from feral stock (Burge, 1986). In Block I, there were an estimated 18 elephant, 248 wild boar *Sus scrofa*, 1,362 spotted deer *Cervus axis*, 384 sambar *C. unicolor* and 513 water buffalo in 1983-1985, as well as 40 or more sloth bear, at least 15 pairs of golden jackal *Canis aureus* and 23-30 leopard (Burge, 1986). The number of elephants varies seasonally, however, with up to 65 recorded in the dry season of 1979 (Santiapillai *et al.*, 1984). Somewhat different estimates of mean densities of large herbivores in Block I were obtained from skull collections and calculation of survival curves from cementum layering of molar teeth, as follows: water buffalo - 280 per sq.km, sambar - 4.0 per sq.km, spotted deer - 12.0 per sq.km, and wild boar - 0.6 per sq.km (Ashby and Santiapillai, 1986).

The avifauna comprised some 120-130 species (Banks and Banks, 1985). Raptors include crested serpent eagle *Spilornis cheela* and white-bellied sea eagle *Haliaeetus leucogaster*. Many waterbirds are attracted to the lagoons, including lesser flamingo *Phoeniconaias minor*, pelican *Pelecanus* sp., spoonbill *Platalea leucorodia*, painted stork *Ibis leucocephalus*, black-necked stork *Ephippiorhynchus asiaticus*, of which there are perhaps only a dozen in the country, grey heron *Ardea cinerea*, purple heron *A. purpurea*, night heron *Nycticorax* sp., egret *Egretta* sp., purple gallinule *Porphyrio porphyrio* and darter *Anhinga melanogaster*. During the north-east monsoon the lagoons are visited by thousands of migrating waterfowl, including pintail *Anas acuta*, garganey *A. querquedula*, white-winged black tern *Chlidonias leucopterus*, curlew *Numenius arquata*, whimbrel *N. phaeopus*, godwit *Limosa* sp., and turnstone *Arenaria interpres*, which mix with the residents such as whistling duck *Dendrocygna* sp., yellow-wattled lapwing *Vanellus malabaricus*, red-wattled lapwing *V. indicus* and great stone curlew *Esacus recurvirostris*. The forests contain orange-breasted green pigeon *Treron bicincta*, hornbills (Bucerotidae), flycatchers (Muscicapidae), including paradise flycatcher *Terpsiphone paradisi ceylonensis*, barbets (Capitonidae) and orioles (Oriolidae), while many peafowl *Pavo cristata* occur on the plains. Further details of the waterfowl are given by Scott (1989).

Notable reptiles are mugger *Crocodylus palustris* (V), which is abundant in abandoned tanks, estuarine crocodile *C. porosus* (E), found in the main rivers, and common monitor *Varanus bengalensis*. Other reptiles include cobra *Naja naja* and Russell's viper *Viper russelli* (T.W. Hoffmann, pers. comm., 1986). A variety of sea turtles breed along the coast, including green turtle *Chelonia mydas* (E), olive ridley *Lepidochelys olivacea* and leatherback *Dermochelys coriacea* (E), for which the Yala coastline is a major nesting ground (Hewavisinghe, 1990).

The lagoon fauna includes various species of prawns, crabs and fishes, details of which are given by the Joint Aberdeen and Colombo Universities Expedition (1978) and summarised by Scott (1989).

Cultural Heritage Yala is steeped in legend and history, having been the centre of bygone civilisations. Here was the Kingdom of the great King Ravana, with its boundary Ravana Kotte now buried in the sea. Lying in the path of seafaring merchants who brought with them the Indo-Aryan civilisation, Yala was the twin cradle of Sinhalese culture. Here was Situlpahuwa, the now-restored abode of twelve thousand arahats which attracts large numbers of pilgrims, Magul Maha Vihare, built in 87 BC, and Akasa Chaithya, constructed in the 2nd century BC. Agriculture flourished during the era of the Maha Ruhuna Kingdom, a civilisation second only to Anuradhapura (S.K.R., 1970). Further details about the history of Yala are given by Samaraweera (1970).

Local Human Population Patanangala, in Block I, is used by fishermen from late September until early April. Originally used by no more than a dozen migrant fishermen from Tangalla, who marketed dried fish for the population on the south coast (Burge, 1986), their numbers have increased to a thousand persons in recent times (T.W. Hoffmann, pers. comm., 1989).

Visitors and Visitor Facilities Some 100,000 visitors were recorded in 1981, 30% of which were foreigners. In Block I, the main area for visitors, there are bungalows at Mahasilawa, Buttawa, Patanangala, Yala, Heenwewa and Talgasmankada, which can be booked in Colombo. The two campsites at Yala and Kosgasmankada are not generally used. There is a small but poorly maintained museum.

Scientific Research and Facilities An extensive vegetation survey was conducted in 1967-1968 (Mueller-Dombois and Fernando, 1969). Various studies of the vegetation, lagoons, avifauna and mammals were undertaken by the Joint Aberdeen and Colombo Universities Expedition (1978) and Aberdeen/Colombo University Ecological Expedition (1979). Mammal species studied include leopard (Santiapillai *et al.*, 1982; Chambers *et al.*, 1984), elephant (Kurt, 1974; Santiapillai *et al.*, 1984), wild boar (Santiapillai and Chambers, 1980), spotted deer (Balasubramaniam *et al.*, 1980), sambar (Santiapillai *et al.*, 1981) and water buffalo (Santiapillai and Chambers, 1982; Ashby and Santiapillai, 1983; Burge, 1986). Work on the elephant was initiated in 1967 as a Smithsonian project, and also involved the University of Peradeniya. Maps of the geomorphology, soils and vegetation of the park, prepared by the Smithsonian Institution, were published by the Ceylon Survey Department in the late-1960s.

Conservation Value Yala is renowned for the variety of its wildlife, largely characteristic of dry zone tropical thorn forest, and its fine coastline and associated coral reefs. A large number of important cultural ruins bear testimony to earlier civilisations and indicate that much of the area was populated and well-developed, with an irrigation system supplying water to the surrounding paddy fields, including those of Yala Plain.

Conservation Management Priorities have yet to be formally identified and outlined in a management plan. Access to the strict natural reserve is strictly limited to research, but Blocks I-V are open to the public although some are not readily accessible and lack facilities. Block I is most frequented by the public, while Block II has a track for four-wheel drive vehicles throughout its length. The latter is a pilgrimage route, used during the Kataragama Festival in July.

Management Constraints The main threats are: entry for poaching, gemming and tree-felling; encroachment by cultivation; and entry by free-ranging domestic livestock (Burge, 1986). Three wardens have already been killed during clashes with poachers (Prestt, 1985). Gems are mined

along the Menik Ganga and, in particular, along the Kumbukkan Oya, where numerous holes dug along the bank extend for up to 30m into the park. The problem of encroachment is particularly acute in Blocks III and IV where chena (shifting cultivation) and burning, to provide grazing in the dry season, impinges on the park boundary. Here, ganja (Indian hemp) is also cultivated in clearings hidden well inside the forest (J.D.N. Banks, pers. comm., 1986). The fishermen at Patanangala poach and disturb wildlife. Moreover, beaches are littered with their debris and turtles in the vicinity are caught in their nets. They have also set up traps inland and they dig up turtle nests (Burge, 1986). The fishing village was closed down by the Department of Wildlife Conservation at one time, but the fishermen were subsequently allowed to return until completion of a new fisheries harbour. This has been finished but is fast silting up and the fishermen remain inside the park (J.D.N. Banks, pers. comm., 1986). Contrary to popular belief (Jonklaas, 1985), water buffalo are considered not to have a deleterious effect on the environment. The species is an important vector of the seeds of certain forbs. However, the gradual change of inland plains from grassland into scrub jungle is inevitable in the absence of hand-weeding, which was practised until the mid-1950s (Burge, 1986). Although visitor numbers have been low due to the recent political unrest, tourism has created problems in the past with, for example, vehicles harassing animals (J.D.N. Banks, pers. comm., 1986). The biggest problem is posed by Situlpahuwa, which has been commercialised and attracts thousands of pilgrims (T.W. Hoffmann, pers. comm., 1989).

Staff One warden, one additional warden, one deputy warden, four rangers, five or six range assistants, about 30 game guards, clerks (1985)

Budget No information

Local Addresses Warden, Park Office, Ruhuna National Park, Palatupana

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Date April 1986, updated September 1990

SERUWILA-ALLAI SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies near Toppur, 25km south-east of Trincomalee, Trincomalee District, Eastern Province. 8°20'-8°25'N, 81°20'-81°23'E

Date and History of Establishment Declared a sanctuary on 9 October 1970.

Area 15,540ha

Land Tenure State

Altitude Sea level

Physical Features A large, shallow, brackish coastal lagoon, known as Ullackalie, lies within the sanctuary. There are extensive mangroves on the shores of the lagoon and at its southern end. The lagoon is permanent and up 2m deep; it is fed by several small streams and is seasonally tidal. During the rainy season, the lagoon is connected to Verugal River to the south by a seasonal channel (Uppu Aru).

Climate Conditions are tropical monsoonal.

Vegetation Comprises dry zone evergreen forest and scrub, with mangroves bordering the lagoon.

Fauna The lagoon is important for waterfowl but no details are available.

Cultural Heritage No information

Local Human Population Activities include subsistence fishing.

Visitors and Visitor Facilities No information

Scientific Research and Facilities No information

Conservation Value The lagoon provides habitat for large waterbirds, migratory ducks and shorebirds. Seasonal floods along the Uppu Aru at the south end of the lagoon are particularly important for migratory waterbirds. The lagoon supports a small fishery.

Conservation Management No information

Management Constraints No information

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

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Date September 1990

SIGIRIYA SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Situated 144km from Colombo and 72km north of Kandy.

Date and History of Establishment Declared a sanctuary on 26 January 1990. The Ancient City of Sigiriya was designated a cultural World Heritage Site in 1982.

Area 5,099ha

Land Tenure State

Altitude No information

Physical Features The topography is flat except for the massive rock outcrop of the fortress itself, and a few adjoining hills.

Climate Conditions are dry except during the north-east monsoon thunder storms occur between October/November and end December.

Vegetation Comprises dry zone forest around the base of the rock, with secondary scrub following shifting cultivation.

Fauna Elephant *Elephas maximus* (E) periodically visits the area in dry periods. Only small animals are present and are seldom reported, due to extensive poaching pressure. Common langur *Presbytis entellus* and endemic toque macaque *Macaca sinensis* are present.

The avifauna comprises species characteristic of dry zone forests, such as jungle robin (shama), paradise flycatcher, leafbird *Chloropsis* spp., Sri Lanka junglefowl *Gallus lafayettei*, and racquet-tailed drongo *Dicurus paradiseus*. Forest eagle owl has been reported and a pair of Shahin falcons regularly nests high up on the rock.

Cultural Heritage The sanctuary surrounds the ancient rock fortress of Sigiriya and includes the ruins.

Local Human Population No information

Visitors and Visitor Facilities The sanctuary is a popular tourist destination. Accommodation is available at Sigiriya Village. There is a rest house adjacent to the rock.

Scientific Research and Facilities No information

Conservation Value The sanctuary surrounds the ancient rock fortress of Sigiriya, an archaeological site of great importance.

Conservation Management No information

Management Constraints No information

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

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Date September 1990

SINHARAJA NATIONAL HERITAGE WILDERNESS AREA

IUCN Management Category IV, IX and X (Managed Nature Reserve, Biosphere Reserve, and World Heritage Site)

Biogeographical Province 4.02.01 (Ceylonese Rainforest)

Geographical Location Situated in the south-west lowland wet zone of Sri Lanka, within Sabaragamuwa and Southern provinces. It is bounded on the north by the Napola Dola and Koskulana Ganga, on the south and south-west by the Maha Dola and Gin Ganga, on the west by the Kalukandawa Ela and Kudawa Ganga and on the east by an ancient footpath near Beverley Tea Estate and by the Denuwa Kanda. 6°21'-6°26'N, 80°21'-80°34'E

Date and History of Establishment Notified a national heritage wilderness area on 21 October 1988 (Gazette No. 528/14). Most of the area was originally declared a forest reserve on 3 May 1875 under the Waste Lands Ordinance and notified in the Ceylon Government Gazette No. 4046, dated 8 May 1875, while the rest was notified a proposed forest reserve in the early 20th century. Sinharaja Forest Reserve, comprising the existing and proposed forest reserves, was declared a biosphere reserve in April 1978, and inscribed on the World Heritage list in 1988.

Area According to Gazette No. 528/14, the total area of the national heritage wilderness area is 18,899 acres and 12 perches (7,648.2ha). The area of the biosphere reserve and World Heritage site as cited in the respective nominations is 8,864ha, of which 6,092ha is forest reserve and 2,772ha is a proposed forest reserve.

Land Tenure State

Altitude Ranges from 300m to 1,170m (Hinipitigala Peak).

Physical Features This narrow strip of undulating terrain consists of a series of ridges and valleys. It is drained by an intricate network of streams, which flow into the Gin Ganga on the southern boundary and Kalu Ganga, via the Napola Dola, Koskulana Ganga and Kudawa Ganga, on the northern boundary. The reserve lies within the transition zone of two important rock types characteristic of Sri Lanka. The south-western group consists of metasediments, charnokites and scapolite-bearing calc-granulites, while the highland group comprises khondalites of metamorphosed sediments and charnokites (Cooray, 1978). Most significant is the presence of the Sinharaja Basic Zone, consisting of hornblende, pyroclasts, basic charnokites, pyroxene amphibolites and scapolite-bearing calc-granulites and blended with small amounts of quartzites, garnet-biotite gneisses and intermediate charnokites (Hapuarachi *et al.*, 1964). This zone coincides with an aeromagnetic anomaly, which has probably contributed to the desilication process responsible for the gem fields in the area (Katz, 1972; Munasinghe and Dissanayake, 1980). Soils, which largely belong to the red-yellow podzolic group, are well-drained and show very little accumulation of organic matter. This characteristic is attributed to a combination of favourable climatic conditions, a diverse soil microflora effecting rapid breakdown of organic matter into constituent nutrients, and accelerated uptake and recycling of nutrients by the trees. Clear-felling of the forest, where most of the nutrients are locked up, therefore renders the soil impoverished of essential nutrients and incapable of supporting sustained commercial forestry or agriculture (Forest Department, 1986). Information on soil profiles and soil microfungi are given in Zoysa and Raheem (1987).

Climate Based on meteorological records gathered from in and around Sinharaja over the last 60 years, annual rainfall has ranged from 3614mm to 5006mm and temperatures from 19°C to 34°C (Zoysa and Raheem, 1987). Most precipitation emanates from the south-west monsoons during May-July and the north-east monsoons during November-January. Conditions are dry in February.

Vegetation Two main types of forest can be recognised. Remnants of *Dipterocarpus* forest occur in valleys and on their lower slopes, with here *D. zeylanicus* and here *D. hispidus* present in almost pure stands. Secondary forest and scrub occur where the original forest cover has been removed by shifting cultivation and in other places the forest has been replaced by rubber and tea plantations (Rosayro, 1954). *Mesua-Doona* (*Shorea*) forest, the climax vegetation over most of the reserve, covers the middle and upper slopes above 500m (Rosayro, 1942) or above 335m as suggested by Gunatilleke and Gunatilleke (1985). *Garcinia hermonii* followed by *Xylopia championii* invariably dominate the understorey tree stratum, a range of species dominate the subcanopy and *Mesua nagassarium* usually predominates in the canopy layer (Gunatilleke and Gunatilleke, 1985). Details about the structure and composition of the vegetation are summarised by Zoysa and Raheem (1987). Of Sri Lanka's 830 endemic species, 217 trees and woody climbers are found in the lowland wet zone (Peeris, 1975). Of these, 139 (64%) have been recorded in Sinharaja (Gunatilleke and Gunatilleke, 1985), 16 of which are considered to be rare (Gunatilleke and Gunatilleke, 1981). Other rare endemics are the palm *Loxococcus rupicola* (R) and *Atalantia rotundifolia*, the latter being restricted to Sinhagala at 742m. Of 211 recorded species of trees and woody climbers, 40% have low population densities (less than or 10 or fewer individuals per 25ha) and 43% have restricted distributions, rendering them vulnerable to further encroachments into the reserve (Gunatilleke and Gunatilleke, 1981). A variety of plants of known benefit to man are present, of which the palm kitul *Caryota urens* (for jaggery, a sugar substitute), wewal *Calamus* sp. (for cane), cardamom *Elattaria ensal* (as

spice), *Shorea* sp. (for flour), dun *Shorea* sp. (for varnish and incense) and weniwal *Coscinium fenestratum* (for medicinal purposes) are used intensively by villagers. A list of 202 plants, together with their endemism and uses is given in the draft conservation plan (Forest Department, 1985).

Fauna An early account of the fauna is given by Baker (1937). Preliminary lists of the fauna (viz. mammals, birds, reptiles, amphibians, fishes and butterflies) have been compiled (March for Conservation, 1985) and are included in the draft conservation plan (Forest Department, 1985). Endemism is high, particularly for birds with 19 (95%) of 20 species endemic to Sri Lanka present. Endemism among mammals and butterflies is also greater than 50%. Threatened mammals are leopard *Panthera pardus* (T) and Indian elephant *Elephas maximus* (E). The endemic purple-faced langur *Presbytis senex* is present. Birds considered to be endangered or rare (Hoffmann, 1984) are Sri Lanka wood pigeon *Columba torringtoni*, green-billed coucal *Centropus chlororhynchus*, Sri Lanka white-headed starling *Sturnus senex*, Sri Lanka blue magpie *Cissa ornata*, and ashy-headed babbler *Garrulax cinereifrons*, all of which are endemic, and red-faced malkoha *Phaenicophaeus pyrrhocephalus*. Of interest is the presence of Sri Lanka broad-billed roller *Eurystomus orientalis irisi* (I), sightings of which have decreased markedly in the last five years (Zoysa and Raheem, 1987). Of the reptiles and amphibia, python *Python molurus* is vulnerable and a number of endemic species are likely to be threatened. Noteworthy species include *Calotes liolepis*, the rarest of all Agamids on the island, the rare rough-nose horned lizard *Ceratophora aspera*, restricted to part of Sri Lanka's wet zone, and *Ramella palmata*, a rare endemic microhylid (Zoysa and Raheem, 1987). Threatened freshwater fish are combtail *Belontia signata* (R), smooth-breasted snakehead *Channa orientalis* (R), black ruby barb *Barbus nigrofasciatus* (V), cherry barb *Barbus titeya* (V) and red-tail goby *Sicydium halei* (V), the conservation status of which is considered in Evans (1981). Of the 21 species of endemic butterfly, Sri Lanka rose *Atrophaneura jophon* is vulnerable (Collins and Morris, 1985). Sri Lankan five-bar sword *Graphium antiphates ceylonicus*, which is considered to be very rare, is not uncommon in Sinharaja at certain times of the year (J.N. Banks, pers. comm., 1986). Zoysa and Raheem (1987) comprehensively summarise what is known about the fauna.

Cultural Heritage The Sinharaja region has long featured in the legends and lore of the people of Sri Lanka. Its name, literally meaning lion (sinha) king (raja), perhaps refers to the original 'king-sized or royal forest of the Sinhalese', a people of the legendary 'lion-race' of Sri Lanka (Hoffmann, 1979), or to the home of a legendary lion of Sri Lanka.

Local Human Population There are two villages within the south-west of the reserve, namely Warukandeniya and Kolonthotuwa, and about 52 families live in the north-western sector. At least 20 other settlements occur on the periphery, an unknown number of which have been illegally established on state land without approval from the relevant authorities. The total population is in excess of 5,000 people. Some land adjacent to the reserve is under private ownership, including small tea and rubber plantations. The extent to which local people are economically dependent on rain forest resources is variable but about 8% of households might be completely dependent (Silva, 1985).

Visitors and Visitor Facilities Visitors are low in number and mostly naturalists. Entry is by permit, obtainable from the Forest Department in Colombo. There are nature trails to the peaks of Moulawella and Sinhalagala. Guidebooks to the Moulawella Trail and to the secondary vegetation have recently been prepared (Gunatilleke *et al.*, 1987a, 1987b). Some

accommodation is available with the Forest Department near the reserve entrance at Kudawa. Further facilities are planned.

Scientific Research and Facilities Among the earliest studies are those of Baker (1937, 1938). Rosayro (1954, 1959), Andrews (1961) and Merritt and Ranatunga (1959) assessed the area's potential for selective logging, based on aerial and ground surveys. Gunatilleke and Gunatilleke (1980, 1981, 1985) examined the floristic composition and phytosociology of woody vegetation and assessed its conservation value. Research on the endemic fauna has been undertaken by WWF/IUCN (Project 1733) and March for Conservation (Karunaratne *et al.*, 1981). Conflicts over the local use of forest resources have been examined by McDermott (1985, 1986) and Silva (1985). An annotated vegetation/land-use map (1:40,000) of the reserve has been produced by the Forest Department (n.d.). The Natural Resources Energy and Science Authority of Sri Lanka has provided a field research station in the reserve. The Forest Department building at Kudawa, outside the reserve, is used by scientists and visitors.

Conservation Value Sinharaja is the last extensive primary lowland tropical rain forest in Sri Lanka. It holds a large number of endemic species of plants and animals, and a variety of plants of known benefit to man.

Sinharaja Forest Reserve meets criteria (ii) and (iv) of the World Heritage Convention, based on the fact that: it is the last viable remnant of Sri Lanka's tropical lowland rain forest; over 60% of the trees are endemic and many of these are rare; and there are 21 endemic bird species, and a number of rare insects, reptiles and amphibians (IUCN Technical Evaluation).

Conservation Management Sinharaja is administered by the Forest Department under the Ministry of Lands and Land Development. Recognising the need for maximum possible protection, it has recently been declared as a national heritage wilderness area under the National Heritage Wilderness Areas Act. Any excision to such an area is permissible only with the concurrence of parliament and the President of the country. The site is also partially protected under the provisions of the Forest Ordinance.

Sinharaja was first recognised in 1936 as being "the only considerable patch of virgin tropical rain-forest in the island" (Baker, 1937). Owing to its inaccessibility and steep, hilly terrain, the reserve remained untouched until 1968 when a government directive was issued to extract timber for the plywood sawmill and chipwood complex established at Kosgama. From 1971 until 1977, when logging was banned, largely due to public pressure with the Wildlife and Nature Protection Society playing a leading role (see Hoffmann, 1972, 1977), about 1,400ha of forest in the western sector were selectively logged (Gunatilleke, 1978; Forest Department, 1986). Presently, the reserve has 6,500-7,000ha of unlogged forest. Since 1977, the Forest Department has given high priority to protecting the reserve and in 1978 began planting *Pinus caribaea* along the periphery to establish a live boundary. More recently, betelnut palm *Areca catechu* has been used for this purpose (Zoysa and Raheem, 1987).

A conservation plan has been officially approved (Forest Department, 1986), implementation of which is being carried out under a cooperative agreement between IUCN and the Sri Lankan government, with additional funding from the Norwegian government (Hails, 1989). In order to ensure the strict protection of the reserve for scientific and aesthetic reasons, a scheme of zonation and management is proposed for areas outside the reserve. The creation and propagation of essential forest products, for sustained utilisation, in areas outside the reserve is intended

to meet local needs and thereby eliminate former dependence on resources within the reserve. Alternative strategies are either to establish a 3.2km-wide buffer zone round the reserve or to enlarge the area protected to about 47,380ha, with the reserve forming a strictly protected core area and surrounding areas set aside as buffers for various uses. The only resource which may still be legally collected, under permit, is kitul (McDermott, 1988). The preferred strategy has been to freeze resource use within the reserve at 1985 levels (when the conservation plan was prepared) and gradually eliminate future resource dependency on the reserve by relocating villages to areas outside the reserve (Ishwaran and Erdelen, 1990).

Management Constraints Of the many constraints to the protection of Sinharaja, socio-economic ones relating to the people and organisations in the immediate vicinity of the reserve are perhaps among the most important. Encroaching cultivations are probably the biggest problem, particularly along the southern boundary (McDermot, 1985). Contractors open up routes to facilitate logging operations and, although no felling is permitted within 1.6km of the reserve boundary, this may render the reserve more accessible to illicit timber operations. Planting of Honduran mahogany *Swietenia macrophylla* along abandoned logging trails as an enrichment species may lead to displacement of natural species, especially as it is a prolific seed producer (Zoysa and Raheem, 1987). Alleged malpractices by the State Timber Corporation are a source of concern for the Forest Department. Private land owners along the periphery perhaps make illegitimate use of timber resources within the reserve: having felled all merchandable timber on their own land, they continue to request permits for timber (Hathurusinghe, 1985). The most important forest produce is firewood, significant quantities of which are used in the production of jaggery (McDermot, 1985; Silva, 1985). The traditional use of minor forest products, most important of which are kitul for jaggery and wewal or cane for weaving baskets, is now restricted to forest surrounding the reserve. Illicit gem mining was considered to be a serious problem in eastern parts of the reserve. It is organised mostly by wealthy merchants from outside the Sinharaja region and needs to be stopped. The lack of a uniform land-use policy and the multiplicity of governmental and semi-governmental agencies involved in land-use planning in Sri Lanka are the major administrative constraints in evolving a suitable protection plan for Sinharaja. For the moment, transactions related to lands surrounding the reserve are suspended under presidential order until such time as the conservation plan for the reserve is ready for implementation (Forest Department, 1986).

Staff Three forest rangers, four beat forest officers (1985). One assistant conservator of forests, three forest rangers, six beat forest officers and 12 forest watchers are proposed in the conservation plan.

Budget The Forest Department has allocated higher than normal amounts of money for the protection of Sinharaja. This reached a record Rs 4 million (US\$ 130,000) in 1987. US\$ 35,000 was made available by WWF/IUCN for a conservation awareness programme and for the purchase of equipment in 1986.

Local Addresses Range Forest Officer, Range Forest Office, Kudawa, Weddagala (An assistant conservator of forests will eventually be responsible for implementing the conservation plan.)

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Date August 1986, reviewed January 1987, updated September 1990

SOMAWATHIYA CHAITIYA NATIONAL PARK

IUCN Management Category II (National Park)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Spans the border between East Province and North Central Province in the deltaic plain of the Mahaweli Ganga. 8°04'-8°19'N, 80°55'-81°17'E

Date and History of Establishment Created a national park on 2 September 1986, having been previously designated a sanctuary on 9 August 1966, and extended through the addition of Block II on 12 May 1987.

Area The 37,762ha national park (Block I: 21,056.8ha, Block II: 16,705.6ha) is contiguous with Flood Plains National Park (17,350ha) to the south, and to Tirikonamadu Nature Reserve (25,019ha). The western arm of the national park (Block II) provides a link with Hurulu Forest Reserve, part of which is protected as a biosphere reserve.

Land Tenure State

Altitude No information

Physical Features The park lies in the deltaic flood plains of the Mahaweli Ganga and encloses the junction where the river bifurcates into the Mahaweli Ganga, flowing north into Koddiyar

Bay, and a lesser branch flowing north-east into the sea at Verugal. The central riverine flood plain is characterised by numerous old river channels and contains scattered 'villus' or water-filled basins among the grassy plains. The fertile alluvial substrate supports high quality habitat, which is of considerable importance for the abundant wildlife.

Climate No information

Vegetation The water-filled basins in the central flood plain are characterised by the abundance and predominance of water-tolerant grasses and aquatic plants. The distribution of vegetation in the villus shows a characteristic pattern, which is related to the period of inundation and the depth of flooding. On the margins, where wet conditions are brief and the depth of flooding slight, there are creeping grasses, such as *Cynodon dactylon*, and various essentially terrestrial annual plants which are capable of surviving wet conditions. Further inwards from the margin, the period of flooding is longer and truly hydrophytic species are apparent such as *Alternanthera sessilis*, *Polygonum* spp., berudiyanilla *Jussiaea repens*, kankun *Ipomoea aquatica*, diyahabara *Monochoria hastata* and *Scirpus grossus*. The most abundant grasses are gojabba *Hygrorhiza aristata*, *Brachiaria mutica*, *Echinochloa colonum*, *Paspalum vaginatum*, *Digitaria longiflora* and *Paspalidium* spp. Inwards from this zone, in slightly deeper water, floating aquatic plants, such as kekatiya *Aponogeton crispum*, *A. natans* and *Nymphoides* spp., occur along with *Nelumbo nucifera*. Beyond this zone, in still deeper water, is an association of manel *Nymphaea stellata* and the submerged aquatic plant *Ceratophyllum demersum*. Common floating plants found in all zones are water lettuce *Pistia stratiotes*, *Salvinia molesta*, diya nidikumba *Neptunia oleracea* and ikiliya *Trapa bispinosa*. Some trees occur in wet conditions around the margins of the flood plain villus. Among these are kumbuk *Terminalia arjuna*, mee *Madhuca longifolia*, mudilla *Barringtonia asiatica*, halemba *Mitragyna parvifolia*, eramadu *Erythrina variegata* and beli-patta *Hibiscus tiliaceus*. In the northern part of the sanctuary, the forest is dense with species such as weera *Drypetes sepieria*, halmilla *Berrya cordifolia*, kunumella *Diospyros ovalifolia*, weliwenna *Dimorphocalyx glabellus*, welang *Pterospermum canescens*, palu *Manilkara hexandra* and halemba *Mitragyna parvifolia* (M. Jansen, pers. comm., 1986). The vegetation of the Mahaweli Ganga flood plains is further described by Scott (1989).

Fauna The ecological importance of Somawathiya is due mainly to the abundance of elephants *Elephas maximus* (E), estimated at about 400 within the sanctuary and its immediate environs, and rich bird life. Noteworthy mammals include jackal *Canis aureus*, fishing cat *Felis viverrina*, rusty-spotted cat *Felis rubiginosa*, leopard *Panthera pardus* (T), wild boar *Sus scrofa*, sambar *Cervus unicolor*, water buffalo *Bubalus bubalis* (E), porcupine *Hystrix indica*, and black-naped hare *Lepus nigricollis*. Typically, the marshes of the flood plain have an interesting and abundant avifauna. Around 75 migrant species are known to winter in the marshes. Common migrants are garganey *Anas querquedula*, marsh sandpiper *Tringa stagnatilis*, wood sandpiper *T. glareola*, pintail snipe *Gallinago stenura*, whiskered tern *Chlidonias hybridus* and black-tailed godwit *Limosa limosa*. Resident birds include painted stork *Ibis leucocephalus*, open-billed stork *Anastomus oscitans*, little egret *Egretta garzetta*, cattle egret *Bubulens ibis*, pond heron *Ardeola grayii*, eastern purple heron *Ardea purpurea*, pheasant-tailed jacana *Hydrophasianus chirurgus*, purple gallinule *Porphyrio porphyrio*, white ibis *Threskiornis melanocephala* and black-winged stilt *Himantopus himantopus*. Within the forests, crimson-breasted barbet *Megalaima haemacephala*, common peafowl *Pavo cristatus*, Malabar pied hornbill *Anthracoceros coronatus*, thick-billed flowerpecker *Dicaeum agile*, common iora *Aegithina tiphia*, endemic junglefowl *Gallus lafayettei* and gold-fronted chloropsis *Chloropsis aurifrons* are noteworthy. Barred buttonquail *Turnix suscitator* frequents open areas, while white-necked stork *Ciconia episcopus*,

crested hawk eagle *Spizaetus cirrhatus*, grey-headed fishing eagle *Ichthyophaga ichthyaetus*, pied kingfisher *Ceryle rudis*, crested serpent eagle *Spilornis cheela* and painted stork are abundant in the marshy areas in the north of the park (M. Jansen, pers. comm., 1986). Further details of the avifauna are given by Scott (1989).

Cultural Heritage The ancient stupa of Somawathiya Chaitiya, built by King Valagamba in 43-17 BC, is located on the left bank of Mahaweli Ganga. It was discovered within the last few decades and is visited annually by large numbers of pilgrims (M. Jansen, pers. comm., 1986).

Local Human Population Comprises itinerant tobacco cultivators and herdsman. There is a large government-owned cattle farm within the park at Kandakadu.

Visitors and Visitor Facilities Planned developments include visitor accommodation. There are plans to improve and extend the existing network of 40km of dry weather roads and tracks.

Scientific Research and Facilities No information

Conservation Value Together with the adjacent Flood Plains National Park, Somawathiya National Park affords protection to a unique habitat, i.e. riverine villus and flood plains, as well as to the largest concentration of elephants within the country. Although the area has been heavily exploited, regeneration will be rapid once human activity is phased out because of the abundance of moisture and high carrying capacity of the villus (Dharmasena, 1985). Both parks are also extremely important for migratory and resident waterfowl (Scott, 1989).

Conservation Management In general, the park has been much neglected (C. Santiapillai, pers. comm., 1986). There is an overall systems plan for protected areas within the Mahaweli region (NPS, 1986) and a management plan is being prepared under the Mahaweli Environment Project.

Management Constraints The site was largely unmanaged and unprotected until it was incorporated into the Mahaweli Environment Project. Areas of forest have been cleared for cultivation, following the influx of tobacco cultivators with their cattle during the last six decades (Hoffmann, 1978; Dharmasena, 1985). Tobacco cultivators enter annually, each with several heads of cattle. In addition, cattle from the Government farms at Tirikonamadu and Kandakadu enter for grazing. Conflicts between wildlife, notably elephants, and livestock at villus are discussed by Ishwaran (1985). Deforestation has become more extensive since the mid-1970s. Illicit exploitation of timber, tobacco cultivation and grazing by cattle are due to be gradually phased out with the establishment of the national park (M. Jansen, pers. comm., 1986). Pilgrims visiting the dagoba and temple are a source of disturbance (T.W. Hoffmann, pers. comm., 1986), while religious festivals held in May, June and July are a source of noise and much vehicle traffic (Dharmasena, 1985).

Staff Two range assistants, five game guards

Budget The park budget is being planned with help from US-AID.

Local Addresses Assistant Director, Department of Wildlife Conservation, Mahaweli Environment Project, Polonnaruwa

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Date November 1985, updated September 1990

TIRIKONAMADU NATURE RESERVE

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies north-west of Batticaloa between the Mahaweli Ganga and the eastern coast of Sri Lanka in North-Central and North-Eastern provinces. 8°05'-8°19'N, 81°10'-81°25'E

Date and History of Establishment Created as a nature reserve on 24 October 1986.

Area 25,019ha. The reserve is contiguous with Somawathiya National Park (37,762ha) along its western boundary.

Land Tenure State

Altitude 2-20m

Physical Features The topography is nearly flat, with some villus. The natural drainage system is characterised by a dendritic pattern of dense shallow drainage lines less than one metre deep. Sandy soils overlie weathered rock materials and granite gneiss at a depth of 1-3m. Topsoil becomes temporarily saturated following the monsoon rains (M. Jansen, pers. comm., 1987).

Climate Mean annual rainfall in the region is 1600mm, most of which falls in the north-east monsoon. Conditions are dry from May to September. Mean annual temperature varies between 27°C and 35°C (NPS, 1986).

Vegetation Characterised by pockets of degraded tropical dry mixed evergreen forest scattered amongst grassland and thorny scrub. Major tree species are palu *Manilkara hexandra*, weera *Drypetes sepiaria*, milla *Vites pinnata*, burutha (satin) *Chloroxylon swietenia*, welang *Pterocarpus canescens* and divul *Feronia limonia* (M. Jansen, pers. comm., 1987).

Fauna Noteworthy mammals are elephant *Elephas maximus* (E), leopard *Panthera pardus* (T), jackal *Canis aureus*, spotted deer *Cervus axis* and wild boar *Sus scrofa*. Estuarine crocodile *Crocodylus porosus* (E) is present, particularly along the Verugal Aru (M. Jansen, pers. comm., 1987).

Amongst the avifauna are common peafowl *Pavo cristatus* and endemic junglefowl *Gallus lafayettei*. In the Upaar Lagoon near the eastern boundary, waders and other waterbirds are present. A variety of waterbirds congregate on the villus in the western part of the reserve, for example: garganey *Anas querquedula*, sandpipers *Tringa* spp., pheasant-tailed jacana *Hydrophasianus chirurgus*, purple coot *Porphyrio porphyrio*, whiskered tern *Chilodoniass hybrida*, egrets, godwits, storks and herons (M. Jansen, pers. comm., 1987).

Cultural Heritage There are ruins of temples at Ilandamodu and Kompanachchi, and stone pillars and statues elsewhere within the reserve (M. Jansen, pers. comm., 1987).

Local Human Population Comprises itinerant tobacco cultivators, herdsmen and farmers.

Visitors and Visitor Facilities None

Scientific Research and Facilities None

Conservation Value The reserve has been created as an integral part of the Mahaweli Environment Project in lieu of the Nelugala Jungle Corridor which was lost to development. Together with Somawithya National Park, Tirikonamadu supports the largest concentration of elephants in Sri Lanka (NPS, 1986).

Conservation Management The main objective outlined in the systems plan is to integrate protected areas into an overall scheme of land use and development within the Mahaweli region (NPS, 1986).

Management Constraints Cattle grazing and tobacco cultivation, particularly along the river banks, are the main disturbances (M. Jansen, pers. comm., 1987).

Staff None

Budget The reserve budget is being met under the US-AID-funded Mahaweli Environment Project.

Local Addresses Assistant Director (Mahaweli), New Town, Polonnaruwa

References

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Date November 1987

UDA WALAWE NATIONAL PARK

IUCN Management Category II (National Park)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies in Sabaragamuwa and Uva provinces and includes the Uda Walawe Reservoir, together with much of its catchment area. The park is surrounded by cultivated land. 6°24'-6°35'N, 80°44'-80°58'E

Date and History of Establishment Created a national park on 30 June 1972 (Government Gazette No.14).

Area 30,821ha

Land Tenure Largely state-owned. Some land is believed to be traditionally owned (Nindagam).

Altitude Ranges from about 100m on the plains to 373m at the top of Ulgala (Hoffmann, 1972).

Physical Features The park consists of the immediate catchment area of the deep Walawe Reservoir (3,400ha), which is surrounded by open plains and foothills. The most prominent feature is the Kalthota Escarpment and spectacular Diyawinne Fall to the north. Ulgala, in the west of the park, is the most prominent peak.

Climate Lying in the dry zone, conditions are characterised by an annual drought coinciding with the south-west monsoon. Mean annual rainfall is about 1524mm. Part of the western sector lies in the intermediate zone and receives a little more rainfall. Mean day and night temperatures are 29.4°C and 23.9°C, respectively (Hoffmann, 1972).

Vegetation Originally forested, grassland and thorn-scrub now predominate. Much of the forest was destroyed by chena (shifting cultivation). Tree species include satin *Chloroxylon swietenia*, halmilla *Berrya cordifolia*, ebony *Diospyros ebenum*, ehala *Cassia fistula*, kolon *Adina cordifolia*, milla *Vitex pinnata*, kon *Schleichera oleosa* and kunumella *Diospyros ovalifolia*. Scattered trees, constituting 20-50% of existing cover, are mainly satin, ehala and lunumidella *Melia dubia*. In the riverine forest, kumbuk *Terminalia arjuna* and the endemic mandorang *Hopea cordifolia* are dominant. Scrub is dominated by damaniya *Grewia tiliaefolia*.

Savanna grasslands are dominated by *mana Cymbopogon confertiflorus*, illuk *Imperata cylindrica* and pogon *Pennisetum olystachyon* (Hoffmann, 1972).

Fauna There are herds of elephant *Elephas maximus* (E) (A.B. Fernando, pers. comm., 1990), while populations of sambar *Cervus unicolor*, spotted deer *C. axis*, muntjac *Muntiacus muntjak*, wild boar *Sus scrofa* and water buffalo *Bubalus bubalis* (E) are gradually re-establishing themselves. Other mammals include: toque macaque *Macaca sinica* (endemic), common langur *Presbytis entellus*, jackal *Canis aureus*, sloth bear *Melursus ursinus* (I), toddy cat *Paradoxurus hermaphroditis*, leopard *Panthera pardus* (T) and black-naped hare *Lepus nigricollis* (Hoffmann, 1972); and small Indian civet *Viverricula indica*, endemic golden palm civet *Paradoxurus zeylonensis*, three species of mongoose *Herpestes fuscus*, *H. smithi* and *H. vitticollis*, an endemic shrew *Suncus* sp., gerbil *Tatera* sp., rat *Rattus rattus kandianus*, soft-furred field rat *Millardia meltada*, Indian bush rat *Golunda ellioti*, mouse *Mus cervicolor* and the endemic *M. fernandoni* (P.B. Karunaratne, pers. comm., 1990).

The avifauna includes large numbers of warblers (*Prinia* spp.), together with the usual low-country birds in forested areas, and a variety of raptors. Waterbirds found on the reservoir include rare visitors such as Indian cormorant *Phalacrocorax fuscicollis* and osprey *Pandion haliaetus* (Banks and Banks, 1985). Notable endemic species are Sri Lanka spurfowl *Galloperoxidix bicalcarata*, Sri Lanka junglefowl *Gallus lafayettei*, Malabar pied hornbill *Anthraceroceros coronatus*, Malabar grey hornbill *Tockus griseus* and brown-capped babbler *Pellorneum fusco-capillum* (Hoffmann, 1972).

Cultural Heritage There are some ruins near Veheramankada.

Local Human Population There were two small purana villages in the centre of the park: Sinukgalla with four families and Nebodawewa with two families (Hoffmann, 1972). These families have since been relocated to Indurugaswewa, outside the park. At the time of the park's establishment, there were an estimated 15,000 squatters (Anon., 1980), most of whom have since been removed.

Visitors and Visitor Facilities Visitors require a permit, obtainable from the Ranger's office at Thimbolketiya, and must be accompanied by a tracker. Accommodation is not available in the park, but circuit bungalows belonging to the Sugar Corporation, Fisheries Corporation and Mahaweli ASL are nearby. The Wildlife and Nature Protection Society is constructing a bungalow near the bund just outside the park. Two camp sites, at Weheramankade and Pansadhara, are located on the east bank of the Walawe River. There is a small hotel at Embilipitiya, about 20 minutes by road from the park.

Scientific Research and Facilities None

Conservation Value Lying in the Intermediate Zone, Uda Walawe is renowned for its outstanding scenic beauty and wealth of faunal species, particularly mammals and birds. The park serves the dual purpose of ensuring a perennial supply of silt-free water to the reservoir and providing a refuge for wildlife displaced by the opening up of land in the lower reaches of the Walawe Ganga (Hoffmann, 1972, 1973; Ariyaratna, 1980).

Conservation Management Following the park's establishment, there was extensive encroachment and about 70% of the forest was destroyed, due largely to chena (shifting cultiva-

tion). In 1979, about 6,000 squatters were evicted, since when there has been appreciable recovery of the vegetation and wildlife populations (A.B. Fernando, pers. comm., 1990). Staffing levels were also increased at that time, resulting in significant improvements in management, and a programme of reafforestation initiated. It remains to be decided, however, what should be done with the extensive teak plantations inside the park once the trees mature. Fishing operations are permitted on the reservoir.

It has been suggested that the park should be extended to accommodate the full range of its elephant population, which migrates as far as Samanalawewa during the wet season. Lying between the Kalthota Escarpment and the Central Range, Samanalawewa is unique with respect to its talawas (savannas) and forest (T.W. Hoffmann, pers. comm., 1990).

Management Constraints In 1977, it was reported that timber was being extracted by contractors licensed by the Forest Department but without the consent of the Department of Wildlife Conservation, legal custodians of the area. This practice has since been stopped. In the same year, two irrigation schemes at Mau-Aru and Guruwela tank were planned but the former scheme was not implemented. Land on the boundary of the park has been allocated to colonists by the government. The land is of poor quality and, when exhausted, could lead to encroachment into the park. Fishermen and gem miners regularly set fire to grasslands, thereby suppressing forest regeneration. A major source of conflict is the 11,330ha sugar cane plantation at Sevanagala, on the southern border of the park, which is raided by elephants (Hoffmann, 1972; R.F., 1977; Ariyaratna, 1980).

Staff 40 staff (1980)

Budget No information

Local Addresses Park Warden, Uda Walawe National Park, P 74, Uda Walawe

References

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Date April 1986, updated September 1990

UDAWATTEKELE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Lies north of Kandy Lake on the periphery of the ancient capital of Sri Lanka, Kandy, in Central Province. 7°19'N, 80°39'E

Date and History of Establishment Declared a sanctuary on 29 July 1938. Udawattekele Forest Reserve (102.8ha) was notified on 15 October 1897 (Notification No. 3504), but its protection and use as a pleasure park probably goes back many centuries. The forest reserve has been designated a national MAB reserve.

Area 111ha

Land Tenure State

Altitude Approximately 500m

Physical Features State

Climate Conditions are similar to those at Kandy, with the south-west monsoon from mid-May to July/August and the north-east from October/November to late December. Annual rainfall is 1615mm and temperatures remain at about 24°C throughout much of the year.

Vegetation Comprises fairly dense forest, mostly plantation and secondary formations.

Fauna Mammals include the endemic toque macaque *Macaca sinica*, jackal *Canis aureus*, mouse deer *Tragulus meminna* and small mammals such civets and porcupine *Hysterix indica*. About 80 species of birds have been recorded from the area. Endemic species include emerald-collared parakeet *Psittacula calthorpae*, yellow-fronted barbet *Megalaima flavifrons* and brown-capped babbler *Pellorneum fuscicapillum*. The rare three-toed kingfisher *Ceyx erithacus* has occasionally been seen.

Cultural Heritage Udawattakele is a Buddhist 'sanctuary' and there is a temple in the vicinity.

Local Human Population The surrounding land is settled.

Visitors and Visitor Facilities The sanctuary is popular with the residents of Kandy, and also receives many other visitors. There is a network of bridlepaths. Facilities are available in Kandy.

Scientific Research and Facilities No information

Conservation Value The sanctuary is important as a recreational area for the inhabitants of Kandy, as well as protecting part of the city's water catchment.

Conservation Management Various recommendations on zonation are made by Weerasinghe (1980).

Management Constraints Fuelwood is illegally collected from the sanctuary (S. Wells, pers. comm., 1986).

Staff Includes a number of forest guards

Budget No information

Local Addresses No information

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Date September 1990

VICTORIA-RANDENIGALA-RANTAMBE SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Spans the Mahaweli Ganga between Kandy and the Minipe Anicut within the administrative districts of Kandy, Nuwara Eliya and Badulla in Central Province. The boundary follows the ridges of surrounding hill ranges. 7°06'-7°22'N, 80°43'-80°58'E

Date and History of Establishment Declared a sanctuary on 30 January 1987.

Area 42,087ha.

Land Tenure Land is largely state-owned but some holdings are under private ownership. It was placed under the jurisdiction of the Mahaweli Authority of Sri Lanka in 1979.

Altitude Ranges from 440m to 1,216m at the top of Wewagalatenna.

Physical Features Topography is characterised by narrow, north-south aligned valleys through which the tributaries of the Mahaweli Ganga drain into the eastward-flowing Mahaweli Ganga. Valleys are steep-sided, generally with a gradient in excess of 30%. Two major new hydro-power and storage reservoirs, namely Victoria (2,400ha) and Randenigala (2,400ha), are located on the Mahaweli Ganga in the middle of the sanctuary, and there are two smaller reservoirs, namely Rantambe on the Mahaweli Ganga and Lower Uma Oya on a tributary of the Mahaweli Ganga. Polgolla diversion barrage, from which waters are diverted to the north-central part of the country, lies within the western boundary. All of these constructions are part of the Accelerated Mahaweli Programme. Randenigala Reservoir contains a number of small islands, together with coves and peninsulas formed as a result of the construction of both Randenigala and Victoria reservoirs. These contribute to the diversity of habitats available to wildlife (M. Jansen, pers. comm., 1987).

Climate Falls largely within the Intermediate climatic zone.

Vegetation Represents a transition between those of wet and dry zones. Hill slopes have a reasonably good forest cover, interspersed with patches of secondary growth where the vegetation is recovering from chena (shifting cultivation). The central part of the sanctuary contains dry mixed evergreen forest, characterised by species such as palu *Manilkara hexandra*, weera *Drypetes sepiaria*, milla *Vitex pinnata*, burutha (satin) *Chloroxylon swietenia* and welang *Pterocarpus canescens*. Other common species are labu *Gyrocarpus americanus*, kiri kon *Walsura piscidia*, ma-dan *Syzygium cuminii* and pethan *Bauhinia tomentosa*. In the higher hills of the north-eastern arm of the sanctuary the vegetation is typically montane and represented by species such as *Elaeocarpus* spp., *Syzygium* spp. and *Calophyllum walkerii*. On the plateau around Madugoda in the extreme north, a distinctive windswept schlerophyllus vegetation with low stature trees is present. South-eastern slopes support dry patana grasslands (M. Jansen, pers. comm., 1987).

Fauna Large mammals include endemic toque macaque *Macaca sinica*, jackal *Canis aureus*, leopard *Panthera pardus* (T), otter *Lutra lutra*, civet cat *Viverricula indica*, elephant *Elephas maximus* (E) (with a herd of 40-50 present), wild boar *Sus scrofa*, spotted deer *Cervus axis*, sambar *C. unicolor*, pangolin *Manis crassicaudata* and black-naped hare *Lepus nigricollis* (M. Jansen, pers. comm., 1987).

The avifauna is rich. Endemics include Sri Lanka junglefowl *Gallus lafayettei*, brown-capped babbler *Pellorneum fuscicapillum* and Sri Lanka spurfowl *Galloperdix bicalcarata*. Migratory birds also visit the area (M. Jansen, pers. comm., 1987).

Among the amphibia is the endemic greater hourglass tree frog *Rhacophorus cruciger*. Reptiles include endemic species such as *Otocryptis wiegmanni*, spotted skink *Mabuya macularia*, smooth skink *Sphenomorphus taprobanensis*, *S. fallax*, great forest gecko *Gymnodactylus frenatus* and *G. kadniyanus*. Snakes are numerous and include python *Python molurus* (V), whip snakes, kraits, wolf snakes, vipers and common cobra *Naja naja*. Fishes include endemic green labeo *Labeo fisheri* (E), which occurs in fast flowing streams (M. Jansen, pers. comm., 1987).

Cultural Heritage Ancient constructions include the noteworthy anicut across the Mahaweli Ganga at Minipe (M. Jansen, pers. comm., 1987).

Local Human Population A number of small villages are located towards peripheral regions of the sanctuary, where rice, tobacco, tea and other cash crops are cultivated. Shifting cultivation is also practised on some hill slopes, but this is of low intensity (M. Jansen, pers. comm., 1987).

Visitors and Visitor Facilities There are plans to develop the sanctuary for water sports, hiking, mountaineering, camping, picnicing, wildlife viewing and photography (M. Jansen, pers. comm., 1987). Accommodation facilities presently available with the Mahaweli Authority are being transferred to the Department of Wildlife Conservation.

Scientific Research and Facilities None

Conservation Value The sanctuary has been set up with the primary objective of protecting the catchments of the reservoirs constructed under the Accelerated Mahaweli Programme. It has great potential for visitors because of its impressive scenery (NPS, 1986).

Conservation Management The sanctuary is being developed under the Mahaweli Environment Project. A pilot project has been initiated to introduce 25 indigenous orchid species threatened elsewhere in their ranges to an island in Randenigala Reservoir. It is planned to introduce other plant and animal species in need of refuge. There are plans to establish the central core of the sanctuary as a national park, including the Victoria, Randenigala and Rantambe reservoirs (Hoffmann, 1987; M. Jansen, pers. comm., 1987). Local residents will retain their rights within the sanctuary but have agreed to be resettled at Andriyabadda.

Management Constraints Major disturbances include the cultivation of private land holdings on hill slopes in peripheral areas of the sanctuary. Land use is most intensive in the narrow western arm of the sanctuary around Victoria Reservoir. Fires regularly occur on the slopes around Victoria Reservoir, but elsewhere they are less of a problem (M. Jansen, pers. comm., 1987).

Staff One game ranger, one range assistant, ten game guards and five ancillary staff (1990)

Budget A very limited budget is available from the US-AID-funded Mahaweli Environment Project.

Local Addresses Game Ranger, Victoria-Randenigala-Rantambe Sanctuary, Urumada, Walapane

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Date September 1987, updated September 1990

WASGOMUWA NATIONAL PARK

IUCN Management Category II (National Park)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Approximately 50km north-east of Kandy in Polonnaruwa and Matala districts, the park spans North Central and Central provinces. The eastern boundary is defined by the Mahaweli Ganga, the western and northern boundaries by the Amban Ganga and the southern boundary is formed for the most part by the Duniwila Oya. The nearest large town is Polonnaruwa, 10km from the northern boundary. The southern part of the park can be reached along a 50km road from Hasalaka. 7°34'-7°57'N, 80°51'-81°05'E

Date and History of Establishment Formerly a strict natural reserve (Lot I) and intermediate zone (Lot II), the Wasgomuwa area was augmented by additional lands acquired under the Mahaweli Environment Project and declared a national park in two phases, with Lots I and II notified on 7 August 1984 and Lot III on 25 January 1980. The strict natural reserve was established in February 1938, having originally been designated a game sanctuary in about 1907, and an area along its northern boundary was declared an intermediate zone (Hoffmann, 1977; St John, 1986). Further historical details are given by St John (1986).

Area Total area is 37,063ha (Lot I: 29,152ha, Lot II: 4,612.8ha, Lot III: 3,298.2ha). The area of the former strict natural reserve was extended by 116.1ha to 29,152.2ha on 8 November 1940 (St John, 1986). Flood Plains National Park (17,350ha) lies immediately to the north-east, downstream from Wasgomuwa. To the north is the 7,529ha Minneriya-Giritale Nature Reserve. The park is contiguous to the proposed Riverine Nature Reserve (920.6ha) on the right bank of the Mahaweli Ganga.

Land Tenure State

Altitude Ranges from about 76m along the Mahaweli Ganga to 535m at the top of Himbiliyande in the Sudukanda Range.

Physical Features The dominant topographic feature is the north-south-aligned Sudukanda Range in the west of the park which forms the divide between the Amban Ganga and the Mahaweli Ganga. An extensive peneplain stretches eastwards from the foothills of the Sudukanda Range to the Mahaweli. It features erosional remnants, such as Nuganagala (142m) in the north and Udawewalanda (109m) towards the south (St John, 1986). Rocks are predominantly pre-Cambian. Their degradation has resulted in a mature peneplain with a thin mantle cover. Soils are reddish-brown earths in the upper catchment areas and alluvial in the floodplains (NPS, 1986a).

Climate Conditions are fairly typical of the dry zone and largely influenced by the north-east monsoon (Maha) in October-February. Inter-monsoonal rains occur in March-May. Annual rainfall increases from about 1750mm in the north to 2250mm in the south. Mean annual temperature is about 27°C, with little variation year-round (NPS, 1986a).

Vegetation Tropical dry mixed evergreen forest predominates, characterised by trees such as weera *Drypetes sepiaria*, palu *Manilkara hexandra*, wa *Cassia roxburghii*, ehale *C. fistula*, buruta (satin) *Chloroxylon swietenia*, velang *Pterospermum canescens*, the endemic galsiyambala *Dialium ovoideum*, milla *Vitex pinnata* and kaluwara (ebony) *Diospyros ebenum*. Dense forests cover the hilly ridges and there is well-developed forest along the major river courses. The riverine forests are dominated by kumbuk *Terminalia arjuna*, owila *Polyalthia longifolia*, mee *Madhuca longifolia*, kunumella *Diospyros ovalifolia* and timbiri *D. malabarica*. In the south-eastern and eastern parts of the park are extensive open plains (clearings) dominated by the grass illuk *Imperata cylindrica* (NPS, 1986a; Jayasingham *et al.*, 1988).

Fauna The known fauna comprises 20 species of mammals, 163 of birds (of which five are endemic to Sri Lanka), 35 of reptiles (of which seven are endemic), 15 of amphibians and 52 of butterflies (Kotagama and Vattala, n.d.). All seven nationally endangered species known from the Mahaweli region are present: a population of around 150 elephant *Elephas maximus* (E), leopard *Panthera pardus* (T), red-faced malkoha *Phaenicophaeus pyrrhocephalus*, common

monitor *Varanus bengalensis*, mugger *Crocodylus palustris* (V), estuarine crocodile *Crocodylus porosus* (E) and python *Python molurus* (V). The park is also noted for its endemic primates (toque macaque *Macaca sinica* and purple-faced langur *Presbytis senex*), sloth bear *Melursus ursinus* (I), spotted deer *Cervus axis*, sambar *C. unicolor* and wild boar *Sus scrofa*. The rare and endemic palm frond frog *Hylarana gracilis* is present. Noteworthy birds include Sri Lanka trogon *Harpactes fasciatus*, racquet-tailed drongo *Dicrurus caeruleus*, endemic yellow-fronted barbet *Megalaima flavifrons*, endemic Sri Lanka junglefowl *Gallus lafayettei* and endemic Sri Lanka spurfowl *Galloperdix bicalcarata*. White-necked stork *Ciconia episcopus* and lesser adjutant stork *Leptoptilos javanicus* occur in the plains (NPS, 1986; M. Jansen, pers. comm., 1986).

Cultural Heritage The most important cultural site is Buduruwayaya in the south-west corner, near the confluence of the Amban and Kalu rivers. These ruins, estimated to be 1800 years old, feature a statue of Buddha reclining and stone pillars. Another reclining Buddha statue is immediately across the Amban Ganga, outside the western park boundary (NPS, 1986a). Remains of an ancient irrigation system provide evidence of early human occupation beside the Mahaweli Ganga and Amban Ganga. The canal known as Kalinga Yoda Ela was constructed by King Parakrama in the twelfth century (Hemapriya, 1981). A ruined palace with stone pillars, located on an island in Kalinga River, is particularly important.

Local Human Population There are no residents in the park. The former strict natural reserve was occupied in places by squatters, who were resettled in adjacent Mahaweli settlement areas prior to the park's establishment.

Visitors and Visitor Facilities Very adequate facilities exist outside the park, with guest houses and hotels available in Polonnaruwa, Giritale and Habarane, and less sophisticated rest houses in Mahigangana and Pallegama. It is proposed that only limited accommodation should be provided inside the park, with campsites and hostels at north and south entrances. Facilities at the north entrance will include a visitor centre (NPS, 1986a).

Scientific Research and Facilities The vegetation has been surveyed by Jaysingham *et al.* (1988) and the fauna by Kotagama and Vattala (n.d.). The relative density of elephants has been examined in grassland and forest habitats (Ishwaran, 1985).

Conservation Value Wasgoma is unusual in its virtual lack of contemporary human disturbance and infrastructure, and its importance as a centre of ancient Sri Lankan culture. Being isolated by large rivers on all but its southern side is a major advantage for management. The park probably contains more wildlife, in terms of both diversity of species and numbers of animals, than any other part of the Mahaweli development area, with the possible exception of the northern part of the proposed Somawathiya National Park.

Conservation Management There is an overall systems plan for protected areas within the Mahaweli region (NPS, 1986b) and a master plan for Wasgomuwa (NPS, 1986a). The purpose of the park is to protect indigenous natural resources and watersheds, to confer benefits to local people in surrounding areas and to provide for limited recreational use. In view of its relatively pristine condition and isolation, it is proposed that development of the park should be minimal and largely confined to the periphery. A system of natural and development zones is envisaged, together with a special use zone along the Amban Ganga, where the landscape is being restored, and 200m-wide peripheral buffer zones to keep wildlife in and domestic animals out. The

southern portion of Flood Plains National Park is included in the Wasgomuwa master plan for administrative purposes (NPS, 1986b).

Management Constraints Possibly the biggest management issue is the tendency for elephants to cross the eastern and southern boundaries into adjacent agricultural areas. Various actions are proposed to reduce conflict between elephants and settlers (St John, 1984, 1986; NPS, 1986a). Other problems are poaching, illegal timber exploitation and gem mining, which is prevalent around the Sudukanda Range (NPS, 1986a). Apart from the obvious disturbance to wildlife and degradation of the habitat, the thousands of abandoned and exposed mine shafts pose a serious hazard to both wildlife and humans. Although pits are now being filled, new ones are still being dug (Hoffmann, 1987a).

The former strict natural reserve has been seriously degraded in recent years. Squatters practised slash-and-burn cultivation for cash crops in large areas of the forest, and an expanding irrigation scheme to the south encroached into the reserve. The squatters have since been resettled outside the new park and the boundaries have been redefined, excluding the irrigation scheme while extending them northwards towards Hurulu Forest Reserve. Part of Wasgamuwa was to be inundated by a dam across the Mahaweli, but these plans were abandoned. Potentially, a new threat is a Japanese-backed project to extend the left bank of Minipe Canal right through the park (T.W. Hoffmann, pers. comm., 1990).

Staff One park warden, 12 game guards and 12 ancillary staff (1990)

Budget The park budget is being planned with help from US-AID.

Local Addresses Park Warden, Wasgomuwa National Park, Wilgamuwa, Hettipola

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WWF/IUCN Project 1783. Elephant management, Sri Lanka.

Date November 1985, updated September 1990

WILPATTU NATIONAL PARK AND WILPATTU NORTH SANCTUARY

IUCN Management Category

Wilpattu National Park:	II (National Park)
Wilpattu North Sanctuary:	IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location The park lies on the north-west coast, 30km due west of Anuradhapura, and spans the border between North West Province and North Central provinces. It is bounded in the north by the Moderagam Aru, in the south by the Kala Oya, and in the west by Portugal and Dutch bays and the open sea. 8°12'-8°32'N, 79°52'-80°10'E

The sanctuary lies inland from the coast and is entirely within Northern Province. It is contiguous with the park, the intervening boundary being marked by the Moderagam Aru. 8°32'-8°35'N, 79°56'-80°01'E

Date and History of Establishment The national park was declared on 25 February 1938, having been created a sanctuary in 1905. Further details of its early history are given by Hoffmann (1969). Wilpattu North Sanctuary was declared on 7 November 1947.

Area	Wilpattu National Park:	131,693ha
	Wilpattu North Sanctuary:	624ha

The park extends is divided into five blocks declared at various times: Block I (54,954ha) on 25 February 1938; Block II (7,021ha) on 28 April 1967; Block III (22,792ha) on 27 June 1969 and enlarged by 189ha on 5 October 1973; Block IV (25,252ha) on 5 December 1969 and Block V (21,484ha) on 7 December 1973. The adjacent areas of Dutch and Portugal bays have been proposed as a marine extension to the park, largely to protect dugong *Dugong dugong* (V) (Bertram and Bertram, 1970; Santiapillai, 1981).

Land Tenure State, except in the case of some cultivated land in the sanctuary (as indicated in the 1969 revision of the 1 inch: 1 mile topographic map)

Altitude	Wilpattu National Park:	ranges from sea level to 152m.
	Wilpattu North Sanctuary:	ranges from 16m to 28m.

Physical Features The western margin of this flat lowland is characterised by littoral sands, overlying sedimentary rocks. Sandstone and red-earth cliffs between Palugaturai and Kudrimalai are a coastal feature not commonly found elsewhere in Sri Lanka. The central portion is dominated by a series of natural waterholes or villus, some of which are permanent. These are formed in shallow depressions over an impervious layer and fill up by surface flow during the monsoons. Approximately 24km from the coast, the underlying rocks change in character from Jaffna limestones to the Vijayan series, a complex conglomerate of supercrustal rocks, including crystalline limestone and granitic gneiss. Soils in the west are generally very poor and intermittently characterised by red-yellow latosols, which are slightly acidic, low in organic matter and low in minerals. In the east, soils are more frequently characterised by fertile reddish brown earths, high in minerals. Other soil types include clays, in areas of former cultivation and tanks, and alluvial deposits along the banks of the major river systems and their tributaries (Eisenberg and Lockhart, 1972).

Climate Characterised by inter-monsoonal rains in March and April, an extensive drought from May until early September and a major rainy season (north-east monsoon) from September until December. Mean annual temperature is 27.2°C and total annual precipitation is approximately 1000mm, based on long-term records at Pomparippu (Mueller-Dombois, 1968).

Vegetation Three types of vegetation can be distinguished: littoral vegetation, including salt grass and low scrub immediately adjacent to the beach; a 5-10 km coastal belt of monsoon scrub of very low stature; and, further inland, monsoon forest with tall emergents, such as pala *Manikara hexandra* and satin *Choroxylon swietenia*. Some 73% of the park is dense forest or scrub and the rest is more open habitat (Eisenberg and Lockhart, 1972). The vegetation has been mapped by Mueller-Dombois and Fernando (1970). Dominant species within various physiognomic classes of vegetation are listed by Eisenberg and Lockhart (1972).

Fauna Mammalian diversity and ecological densities are highest in such ecotones as the interfaces between forest, scrub and grassland in the west and the villus and drainage systems in the centre of the park. A total of 31 species of mammal have been recorded but additional species of Rodentia and Chiroptera are undoubtedly present (Eisenberg and Lockhart, 1972). Threatened mammals are elephant *Elephas maximus* (E), with an estimated 70 residents (1969), sloth bear *Melursus ursinus* (I), leopard *Panthera pardus* (T), the dominant carnivore with a population size estimated at less than 20 residents (1969), and water buffalo *Bubalus bubalis* (V), numbering about 160 residents (1969). Of the herbivores, elephant exhibits the lowest numerical density but accounts for the second highest biomass, exceeded only by spotted deer *Cervus axis* which, at an estimated 3,500 (1969), is the most numerically abundant species. The elephant population is currently estimated at 200-300 (T.W. Hoffmann, pers. comm., 1990). Dugong *Dugong dugong* (V) occurred in Dutch and Portugal bays, adjacent to the park (Bertram and Bertram, 1970), but its present status is uncertain.

The villus support a variety of resident and migratory waterfowl, including large breeding populations of painted stork *Mycteria leucocephala* and open-billed stork *Anastomus oscitans* (Scott, 1989). Other wetland species include garganey *Anas querquedula*, pintail *A. acuta*, whistling teal *Dendrocygna javanica*, spoonbill *Platalea leucorodia*, white ibis *Threskiornis melanocephala*, large white egret *Egretta alba*, cattle egret *Bubulens ibis* and purple heron *Ardea pupurea*. Indian darter *Anhinga melanogaster* is abundant in the vicinity of those villus which support a fish fauna. Common in the vicinity of villus are white-shafted little tern *Sterna albifrons*, gull-billed tern *Gelochelidon nilotica*, whiskered tern *Chlidonias hybridus*, great

stone-curlew *Esacus recurvirostris*, black-winged stilt *Himantopus himantopus* and red-wattled lapwing *Lobivanellus indicus*. Among the more noticeable forest or scrub birds are greater raquet-tailed drongo *Dicrurus paradiseus*, paradise flycatcher *Terpsiphone paradisi*, crimson-breasted barbet *Megalaima haemacephala*, green barbet *M. zeylanica*, Malabar hornbill *Anthracoceros coronatus*, little green bee-eater *Merops orientalis*, kingfisher *Alcedo atthis*, nightjar *Caprimulgus macrurus*, and brown fish owl *Ketupa zeylonensis*. Galliformes are well represented by peafowl *Pavo cristatus* and Sri Lanka junglefowl *Gallus lafayettei*. Common raptors include crested serpent-eagle *Spilornis cheela*, white-bellied sea eagle *Haliaeetus leucogaster* and crested hawk-eagle *Spizaetus cirrhatus*. Among the most conspicuous reptiles are common monitor *Varanus bengalensis*, mugger *Crocodylus palustris* (V), common cobra *Naja naja*, rat snake *Ptyas mucosus* and Indian python *Python molurus* (V). Pond turtle *Melanochelys trijuga* and soft-shelled turtle *Lissemys punctata* are resident in most of the larger permanent villus. Star tortoise *Testudo elegans* is common in grasslands. Termites of the genus *Trinervitermes* probably account for the most significant proportion of the invertebrate biomass. Termite activity is highest in scrub and scrub-forest, and minimal in grassland (Eisenberg and Lockhart, 1972).

Cultural Heritage Much legend and history is associated with the park and its immediate surroundings. Vijaya landed at Kudrimalai in about 500 BC and founded the Sinhalese race. According to legend, Vijaya married Kuveni, the jungle princess, whose palace lies in ruins at Kali Villu. North-east of Maradanmaduwa are Wirandagoda and Galbendi Niraya where Prince Saliya, son of King Dutugemunu, is reputed to have lived with his 'forest' bride of lowly caste, Asokamala, some 2,000 years ago. Kudrimalai, or Horse Point, was visited by a subject of Emperor Claudius in 47 AD, who was blown off course by the monsoon. The local king later sent his own envoys to Rome during the time of Pliny. The palace of Queen Alirani, or Aliserani, is reputed to lie buried at Kudrimalai. Pomparipau is an archaeological site where sealed urns containing human remains have been found. These burials were probably in pre-Vijayan times. There are engraved stone boundary posts from ancient Sinhalese times at Konwetiya and elsewhere. Between Palagaturai and Kollankanatte are the remains of an old harbour (Samaraweera, 1970). The ruins of an ancient Hindu temple sit on the top of Kudrimalai Point. Nearby, on the beach lies the grave of a Muslim saint. The old catholic church at Pallakandal is visited by several thousand pilgrims for the annual festival (T.W. Hoffmann, pers. comm., 1986). In the eastern part are remnants of breached tanks left over from the agricultural systems of ancient Sinhalese civilizations.

Local Human Population There are seasonal fishing camps near Kudrimalai (Tammannawa) and at Palugaturai, Kollankanatte and Wellamundel. The fishing village of Pookulam, south of the mouth of Moderagam Aru, has been excised from the park, together with some surrounding land and a tank (T.W. Hoffmann, pers. comm., 1986).

Visitors and Visitor Facilities The park is presently closed because of security problems. In the early 1980s, prior to its closure, the park received some 25,000-30,000 visitors per year. There are seven lodges: Maradamaduwa, Pannikar Villu, Kalli Villu, Mana Wila, Thala Wila, Manikapola Uttu and Kokmottai. All overlook villus except the last which is by the Moderagam Aru. Most of these are closed towards the end of the dry season in August-September. Another lodge at Makalanmaduwa has never been used since its construction in the late 1970s. A lodge belonging to the Wild Life and Nature Protection Society of Sri Lanka lies just outside the park, and The Wilpattu Hotel is some 24km distant. There is a good network of gravel roads, particularly between waterholes. A museum is situated at Hunuwilagama.

Scientific Research and Facilities The park was surveyed over a period of 14 months in 1968-1969, as part of an elephant study program undertaken by the Smithsonian Institution (Eisenberg and Lockhart, 1972). A botanical reconnaissance was carried out at the same time (Mueller-Dombois and Fernando, 1970). Muntjac *Muntiacus muntjac* was the subject of a behavioural study in 1972-73 (Barrette, 1975, 1977). There are no research facilities.

Conservation Value Wilpattu National Park is among the oldest and most important of protected areas in Sri Lanka. Its flora and fauna are representative of the dry lowland zone. It also contains a number of important cultural sites. Extension of the park to include the adjacent waters is identified as a priority in the Corbett Action Plan (IUCN, 1985). The sanctuary is important as a buffer to the park.

Conservation Management Management of the sanctuary comes under the remit of the warden of the national park. Law enforcement activities came to a standstill in 1985 following the massacre of park employees by terrorists. Several attempts have been made to drive elephants from System 'H' of the Mahaweli Development Area into the park, beginning in 1978/1979. Most attempts have been unsuccessful, with elephants returning to their former range (Jayewardene, 1984, 1986). Recently, attempts have been made to enrich the habitat for elephant by planting grass.

Management Constraints The protected areas complex lies in a conflict zone between Tamil and government forces. On 14 May 1985, 24 park employees were killed by terrorists escaping to the coast, following which the park and sanctuary were closed to visitors. Subsequent improvement and construction of two roads for military purposes resulted in considerable damage to the habitat (Hoffmann, 1987); the roads have since been abandoned (T.W. Hoffmann, pers. comm., 1989). Well-organised illegal extraction of timber and poaching have always been a major problem facing the insufficiently numerous and ill-equipped guard force (Alwis, 1984). More recently, this has been exacerbated by the activities of army personnel stationed within the park (T.W. Hoffmann, pers. comm., 1990).

Some animals migrate from the park in times of drought, exposing them to dangers from hunting. Expanding villages in areas adjacent to the park threaten its integrity. Restoration of two tanks (Maha Andaragollewa and Mahawewa) to full irrigation capacity by the Mahaweli Authority has not benefitted wildlife because they have become overgrown with *Salvinia* and secondary vegetation (T.W. Hoffmann, pers. comm., 1986). Monks are being settled by the Chief Priest near Tantirimalai, an ancient Buddhist site that was formerly a hermitage for 2-3 monks. A 30 sq.km enclave on the park boundary has been allocated for this purpose (Department of Wildlife Conservation, pers. comm., 1990).

Encroachment and settlement within the sanctuary is extensive due to the absence of law enforcement during the recent political unrest (Department of Wildlife Conservation, pers. comm., 1990).

Staff The park was administered by 80 staff, under a warden, up until 1985. Staff are temporarily stationed outside the park.

Budget No information

Local Addresses Warden, Park Office, Wilpattu National Park, Hunuwilagama, Nochchiyagama

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Date April 1986, updated September 1990

WIRAWILA-TISSA SANCTUARY

IUCN Management Category IV (Managed Nature Reserve)

Biogeographical Province 4.13.04 (Ceylonese Monsoon Forest)

Geographical Location Situated near the townships of Wirawila and Tissamaharama, Hambantota District, Southern Province. 6°16'-6°17'N, 81°14'-81°19'E

Date and History of Establishment Declared a sanctuary on 27 May 1938.

Area 4,164ha

Land Tenure State

Altitude Approximately 900m

Physical Features The wetland comprises three tanks (water storage reservoirs): Wirawila Wewa (300ha), Tissa Wewa (150ha) and Debara Wewa. Wirawila is a shallow tank with scattered dead trees and grassy shoreline; it is surrounded by scrub jungle and cultivation. At low water levels, large areas of bare mud are exposed.

Climate Conditions are tropical monsoonal.

Vegetation No information

Fauna Wirawila used to be frequented by large waterbirds, notably grey pelican *Pelecanus philippensis* (e.g. 400 in September 1972), cormorants, herons, egrets, storks, ibises and spoonbills, and is still an important wintering area for ducks and shorebirds in some years. Water levels were very high in January 1986 when few birds were present. In January 1987, however, large numbers of garganey *Anas querquedula*, pintail *A. acuta*, Indian whistling duck *Dendrocygna javanica*, and gull-billed tern *Gelochelidon nilotica* were present. In January 1988, conditions were again poor and the only birds present were 1,000 Indian whistling duck and small numbers of black cormorant *Phalacrocorax niger*, herons, and egrets (five species), black-winged stilt *Himantopus himantopus* and a few other shorebirds. The other tanks are known to be important for waterfowl, but few details are available.

Fishes recorded from Wirawila include *Puntius sarana*, *Puntitius dorsalis*, *Ompok bimaculatus*, *Heteropneustes fossilis*, *Macrones vittatus*, *Tilapia mossambica* and *Glossogobius giuris*.

Cultural Heritage No information

Local Human Population No information

Visitors and Visitor Facilities No information

Scientific Research and Facilities No information

Conservation Value The sanctuary is an important wetland, although Wirawila is less used by waterfowl than formerly.

Conservation Management No information

Management Constraints No information

Staff No information

Budget No information

Local Addresses No information

References Information is taken directly from:

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Date September 1990

YALA EAST NATIONAL PARK

IUCN Management Category II (National Park)

Biogeographical Province 4.13.04 (Ceylonese monsoon forest)

Geographical Location Lies on the south-east coast in Eastern Province, 12km south of Arugam Bay, and is accessible from the Wellawaya-Pottuvil Road. Contiguous to the south with Ruhuna (Yala) National Park/Yala Strict Nature Reserve (126,786ha), along the Kum-bukkan Oya. 6°30'-6°42'N, 81°04'-81°15'E

Date and History of Establishment Block II was established on 26 December 1969, followed by Block I on 2 January 1970, having originally been reserved for shooting as an intermediate zone many years beforehand.

Area Total area is 18,149ha, with 285.3ha in Block II and 17,863.4ha in Block I.

Land Tenure Land is state-owned, but the people of Kumana Village, located within the park, enjoy certain rights.

Altitude Ranges from sea level to 90m-high rocky outcrops.

Physical Features The main feature is the world famous Kumana mangrove swamp (c. 200ha), which is surrounded by plains and jungle. The flat terrain of the coast is broken by numerous, rocky outcrops. There are large saline lagoons along the coast, often surrounded by extensive plains.

Climate Conditions are similar to those experienced in the north of Ruhuna National Park.

Vegetation Comprises semi-arid thorn-scrub with fairly large areas of dense forest. Important species of tree are palu *Manilkara hexandra*, weera *Hemicyclia sepiaria*, mayila *Bauhinia racemosa*, ehala *Cassia fistula*, satin *Chloroxylon sweitenia* and malithan *Salvadora persica*. Around the marshy swamps are kirala *Sonneratia caseolaris* and hambu *Mitragyna parvifolia* (M. Jansen, pers. comm., 1986).

Fauna In general, the fauna is similar to that found in Ruhuna National Park. Kumana is reputed for its avifauna. Large numbers of certain species congregate to nest in the mangroves in May-June (Banks and Banks, 1985). Common birds include pelican *Pelecanus* sp., painted stork *Ibis leucocephalus*, spoonbill *Platalea leucorodia*, white ibis *Threskiornis melancocephalus*, open-billed stork *Anastomus oscitans*, purple heron *Ardea purpurea*, grey heron *A. cinerea*, egrets *Egretta* spp., pond heron *Ardeola grayii*, night heron *Nycticorax nycticorax*, Indian darter *Anhinga melanogaster* and cormorant *Phalacrocorax niger*. Moorhen *Gallinula chloropus*, water cock *Gallicrex cinerea*, purple moorhen *Porphyrio porphyrio*, pheasant-tailed jacana *Hydrophasianus chirurgus*, black-winged stilt *Himantopus himantopus*, whistling teal

Dendrocygna javanica and little grebe *Podiceps ruficollis* are also present, as is black-necked stork *Xenorhynchus asiaticus*, one of Sri Lanka's rarest birds.

Cultural Heritage At the base of most rock outcrops are caves, some with rock inscriptions of the first and second centuries BC. A nine-metre statue of the reclining Buddha, now ruined, was discovered in a large cave at Bambaragastalawa. Bowattagala is another ancient monastic site. Kudumbigala, just outside the park, is inhabited by a Buddhist monk. Both Kudumbigala and Lenama, also peripheral to the park, were once the hunting grounds of the Nittaewo, the legendary pygmies of Sri Lanka who were sworn enemies of the Veddas (Jayawickreme, 1970; M. Jansen, pers. comm., 1986).

Local Human Population The village of Kumana is inhabited by 14-15 families (M. Jansen, pers. comm., 1986), of which most male members work for the park authorities.

Visitors and Visitor Facilities The park is rarely visited now that it is under Tamil occupation. There are two park bungalows, one at Okanda, near the park entrance, and the other by the waterhole at Thunmulla. A campsite is situated on the banks of the Kumbukkan Oya at Kumana. A boat is available for hire at Kumana Villu.

Scientific Research and Facilities Limited to a few avifaunal studies.

Conservation Value Together with Ruhuna National Park, Yala East National Park is renowned for the variety of its wildlife, largely characteristic of dry zone tropical thorn forest. In addition, the mangroves of Kumana provide particularly important habitat for birds.

Conservation Management None at present. Some years ago initiatives were taken to relocate the inhabitants of Kumana Village. Construction of a new village of concrete huts was begun outside the park, but the plan was abandoned when it was discovered that there was no water in the area.

Management Constraints Following several terrorist incursions to the park in 1985, staff were withdrawn. In the absence of the park authorities, villagers (mostly Muslim) from Panama and Arugum Bay have been poaching deer and water buffalo and removing many valuable trees (J.N.D. Banks, pers. comm., 1986).

Staff Temporarily removed, except for those stationed at Kumana Village.

Budget None

Local Addresses Warden, Yala East National Park, Okanda

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